POWER

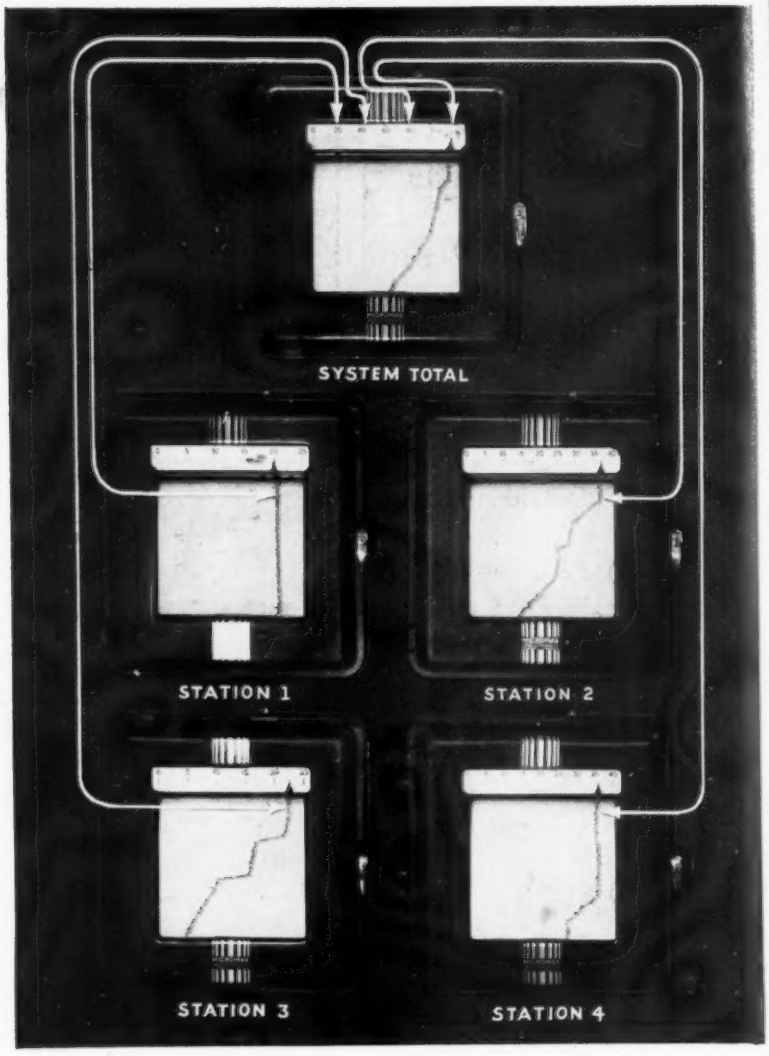
GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

PUBLIC LIBRARY
MAR 12 1947
DETROIT

MARCH 1947

THIS ISSUE: Experiences in the treatment of 1,600,000 lb per hr of raw water, ... reducing fan operating and maintenance costs by proper installation, p 85

TABLE OF CONTENTS, p 59



Typical Micromax Load Recorders with schematic load records drawn in, to show an up-to-the-second load "map" for system operators.

LOAD "MAPS" BY MICROMAX HELP FIND THE WAY TO AVAILABLE CAPACITY

A dozen times a day . . . or perhaps a hundred . . . Micromax Load Recorders can help decide some detail which affects a power system's efficiency.

An unexpected load peak develops, for instance. Will the extra power be provided on a hit-or-miss basis, from whatever generators happen to pick it up? Or will the load dispatcher be able instantly to select the correct station, and phone the pick-up directions? Obviously, everyone concerned prefers the latter method, because it draws power from the source which is most efficient under the specific conditions of time, place and demand.

With Micromax Recorders to help, this efficient course is easy. The instruments show every station's instantaneous load, and every tie's load. And they also indicate all available capacities . . . facts which sometimes evade the dispatcher's memory.

The Recorders thus create what might be called a [illegible] "Map." They help the dispatcher to find the r[illegible] through the system diagram, to the station which [illegible] available capacity for load increases, or which can best drop some load during decreases.

This "mapping" is an addition to the value which Micromax Recorders have, in holding load schedule[illegible] proving that they are held, and in the other functions which are primarily supervision and management. For a complete discussion of the equipment, see Catalog N-58-161, or ask an L&N engineer to call.

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

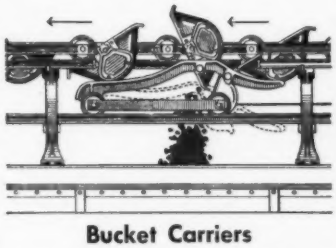
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl. Ad N-58-161(4)

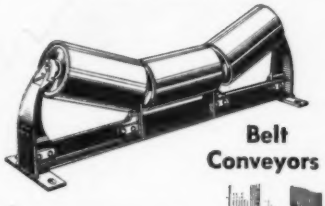
POWER (with which are consolidated "[illegible]," Vol. 91 No. 3. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and executive offices, 330 West 42nd Street, New York 8, N. Y. Entered as second class matter August 25, 1916, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions $5 for one year, $8 for two years, 50c per copy. Canada, $6 for one year, $9 for two years. Pan American, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years.

LINK-BELT EQUIPMENT

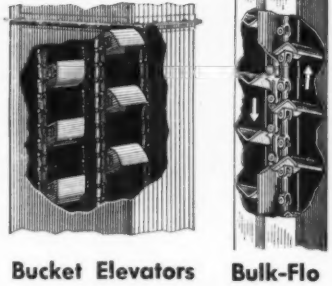
Meets Every Need of Industry in Handling Materials



Bucket Carriers



Belt Conveyors

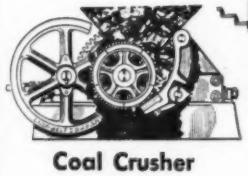


Bucket Elevators

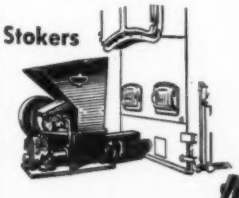
Bulk-Flo

Screw Conveyor

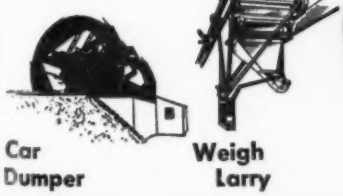
Skip Hoist



Coal Crusher



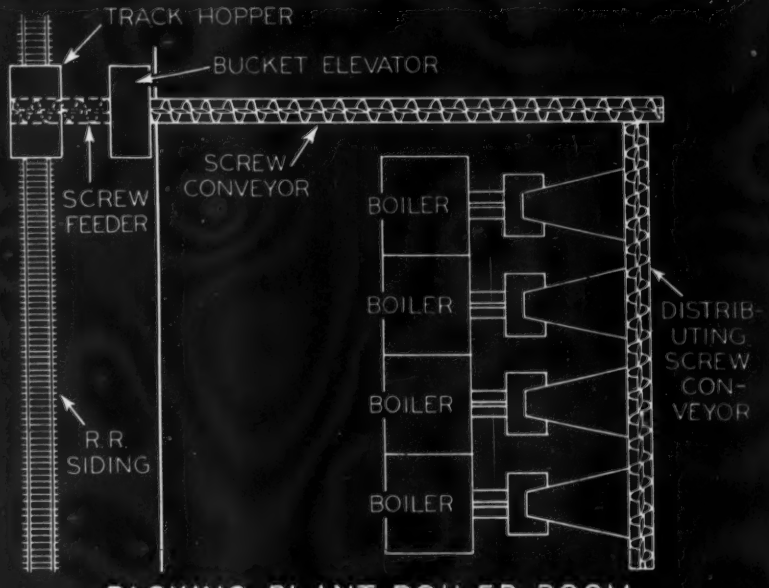
Stokers



Car Dumper

Weigh Larry

CUTTING COSTS WITH CONVEYORS



PACKING PLANT BOILER ROOM

PUBLIC LIBRARY
MAR 12 1947

The Boiler Room Was a "Gold Mine"

NOTE to plant men who need to cut expense corners to combat high material and labor costs: your boiler room may be a "gold mine" for savings.

With the packing plant boiler house coal handling layout shown above, a problem was solved by a combination of Link-Belt units. Through a screw feeder, bucket elevator, screw conveyor and distributing screw conveyor, coal is handled from gondola cars to stoker hoppers. The services of only one man are required for unloading and maintenance. There is no coal dust problem.

The best team efficiency occurs when each man is a star at his own position. On the Link-Belt conveyor team are stars for any conveyor function, with a top-flight coach (the Link-Belt engineering department), to coordinate the overall result. Link-Belt makes Screw Conveyors . . . Bulk-Flo Elevator-Conveyors . . . Overhead Trolley Conveyors . . . Bucket Elevators . . . Skip Hoists . . . Belt Conveyors . . . The Sidekar-Karrier . . . Apron Conveyors . . . The Peck Carrier . . . Flight Conveyors . . . and many others.

Let us develop an efficient low-cost solution to your coal handling problem.

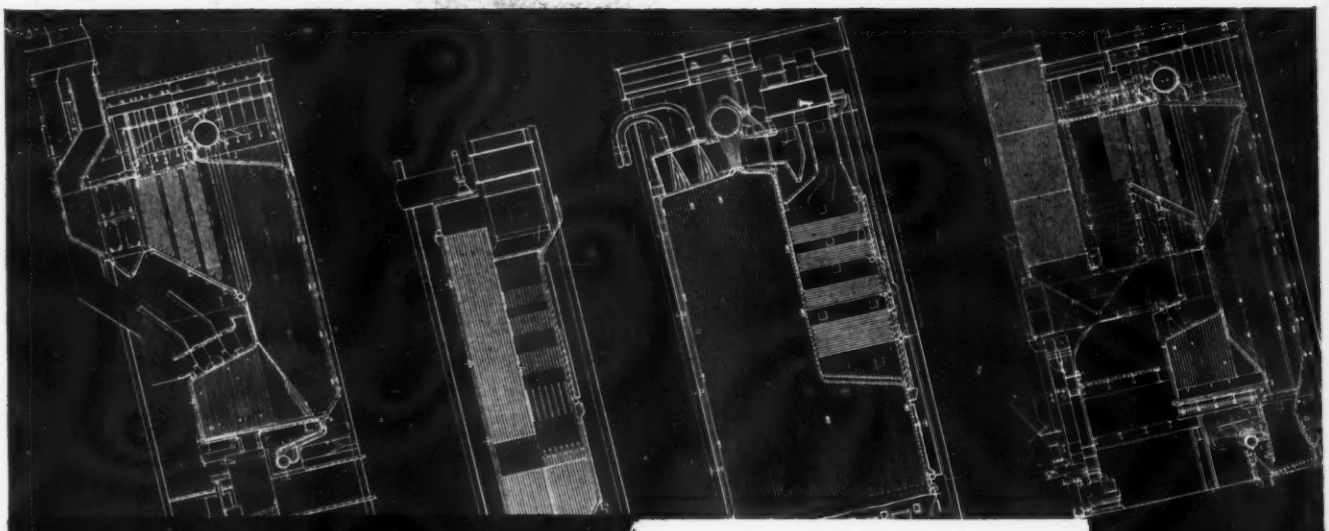
LINK-BELT COMPANY 10,547

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

LINK-BELT

COAL AND ASHES HANDLING EQUIPMENT

in the
SEARCH for lower costs



RESEARCHING for lower costs

Impressive are the statistics B&W could quote: number of boilers in service, records of long service life, and low costs of steam in utility and industrial plants everywhere . . .

But more important are the advances, born of B&W research, that make the figures possible, that *explain* the broadening preference for B&W Boilers wherever the quest for lower power cost is pursued.

Through developments that B&W pioneered, power plant designers, engineers, and operators secure today the advantages of furnaces that efficiently burn, in one unit, a wider range of fuels than has been possible heretofore.

Continuous operation at full load is provided by good burner design and selection of furnaces of proper shape and size and having suitable wall constructions. Efficient operation of boiler, superheater, and economizer surfaces is maintained through adequate provision for automatic soot blowers. Developments of several types of attemperator control and proper location of superheaters provide a superior control of steam temperatures.

Most important, though: B&W research *continues* . . . to be reflected in the still more favorable operating statistics of tomorrow. B&W engineers are ready when you are to discuss *future* power plans.

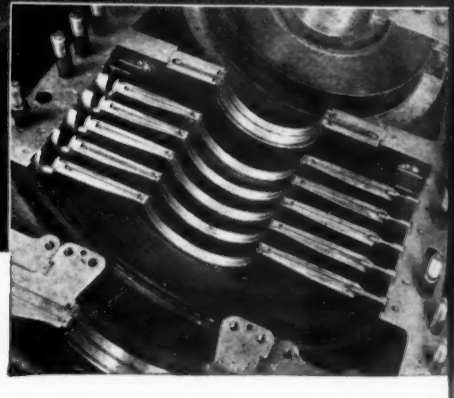
G-365T

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: ALLIANCE AND BARBERTON, O.; AUGUSTA, GA.

What it



The rotor lowers into place with the generous clearance characteristic of the impulse type of turbine—an important advantage for dependable operation.

Diaphragms with milled nozzles, and interstage metallic packing, locked in casing grooves.

Elliott

takes . . . to make a turbine that can take it

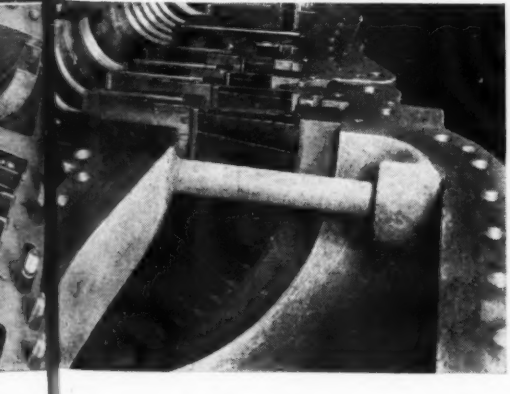
It takes design experience with a background of years, and the gathering of data from many previous installations . . . Close attention to detail . . . Fine workmanship . . . and the ability to meet the specific conditions under which the turbine is to operate . . . Elliott engineers and the Elliott shops have long demonstrated their possession of all these qualifications.

For instance, turbine buckets (see the photo at lower right). These are of many sizes and shapes painstakingly developed to meet the requirements of the various stages. They are machined to extremely close tolerances for a force fit in the wheel rim, and the steam-guiding surfaces are machined, ground and polished on a pre-determined arc for strength and to obtain the maximum aerodynamic lift from the steam with the minimum energy loss in the flow stream due to friction and sudden changes of section. Diaphragms which hold the nozzles and sealing rings are designed and built with equal care.

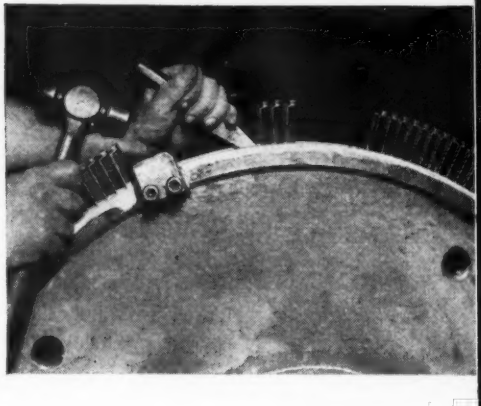
Elliott turbines have long been noted for their downright reliability, ruggedness and conservative design. It is details like these that have formed the basis for that reputation. Elliott engineers are constantly seeking improvements that will further add to these notably Elliott characteristics.

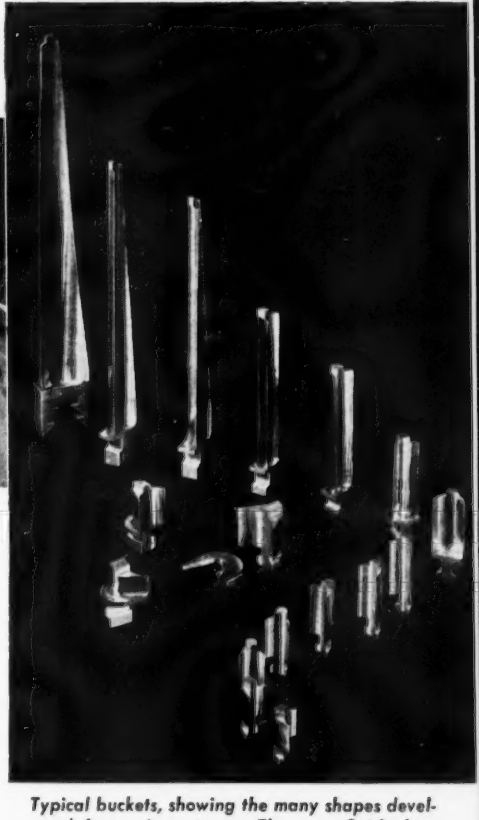
ELLIOTT COMPANY
***Steam Turbine Department,* JEANNETTE, PA.**
Plants in: JEANNETTE, PA. • RIDGWAY, PA. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

In the low-pressure stages cast-in nozzle wall section type of diaphragm is used.



Inserting the buckets into place in the wheel rim. Close tolerance here insures stiffness and strength.





Typical buckets, showing the many shapes developed for various stages. They are finished to accurate size, and polished. Heavy sections insure low stress.

Turbines

H-703

DIAMOND *Automatic Sequential*

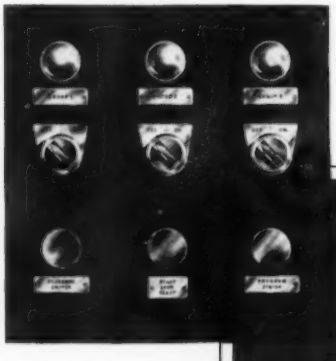
HAS MANY IMPORTANT ADVANTAGES

Description—All soot blower units on the boiler, superheater, economizer and air heater (whether fixed element, retracting or telescopic) are controlled from a single panel such as the one shown below. To begin the cleaning of the entire unit, simply press one button marked "start;" all blowers then operate in correct sequence without attention.

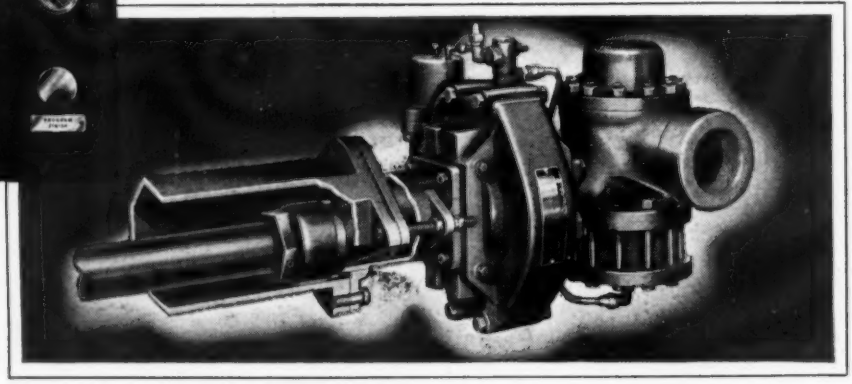
The soot blowers are usually arranged in groups; within each group, automatic sequential blowing of the units takes place. Any group can be operated independently of any other group if desirable by simply throwing a switch on the control panel. Blowing sequence of the units in any group can also be easily changed to suit conditions.

The compressed air for cleaning is discharged from the element nozzles in a series of short puffs. At each puff, the element is automatically repositioned. Spreading the cleaning cycle over a longer period of time permits use of a very small compressor.

The Diamond Automatic Sequential Soot Blower System has been in central station use on boilers as large as 900,000 lb/hr units since 1940. Its many important features are discussed on the right-hand page.



Program panel at left controlls both fixed and retracting blowers arranged in three groups; any desired number of groups can be had when system is designed. Entire soot blowing system is operated in correct sequence by simply pushing "start" button.



Shown above is the Diamond Air Puff Soot Blower having element permanently installed inside the setting; various types of retracting soot blowers are also used in the Diamond Automatic Sequential Air Soot Blower System.

DIAMOND POWER

AIR SOOT BLOWER SYSTEM

CORRECT CLEANING ASSURED — 1

The "human element" is entirely eliminated from soot blowing; the automatic sequential operation assures positive operation of each blower unit in correct sequence and at right speed every time. No blower unit can be overlooked by careless operator.

SAVES LABOR — 2

Automatic sequential operation eliminates need for an attendant to drain the piping, warm it up, and then operate each individual blower unit. On one medium size boiler this labor saving is estimated at more than $3000 per year.

NO FEED WATER MAKEUP — 3

Using compressed air instead of steam as the cleaning medium, there is no condensate loss due to soot blowing. This is particularly important where makeup water is a problem.

SAVES FUEL — 4

Experience gained during several years' operation on a number of installations indicates that automatic sequential air puff soot blowing uses only 1/3 to 2/3 of the energy from the coal pile that is needed for steam blowing.

ELIMINATES STACK DISCHARGE NUISANCE — 5

Intermittent operation expels the soot from the boiler in small quantities that are readily handled by the dust collector. In an installation without dust collectors, it has permitted daylight blowing in a metropolitan district having a smoke abatement ordnance.

REDUCES MAINTENANCE — 6

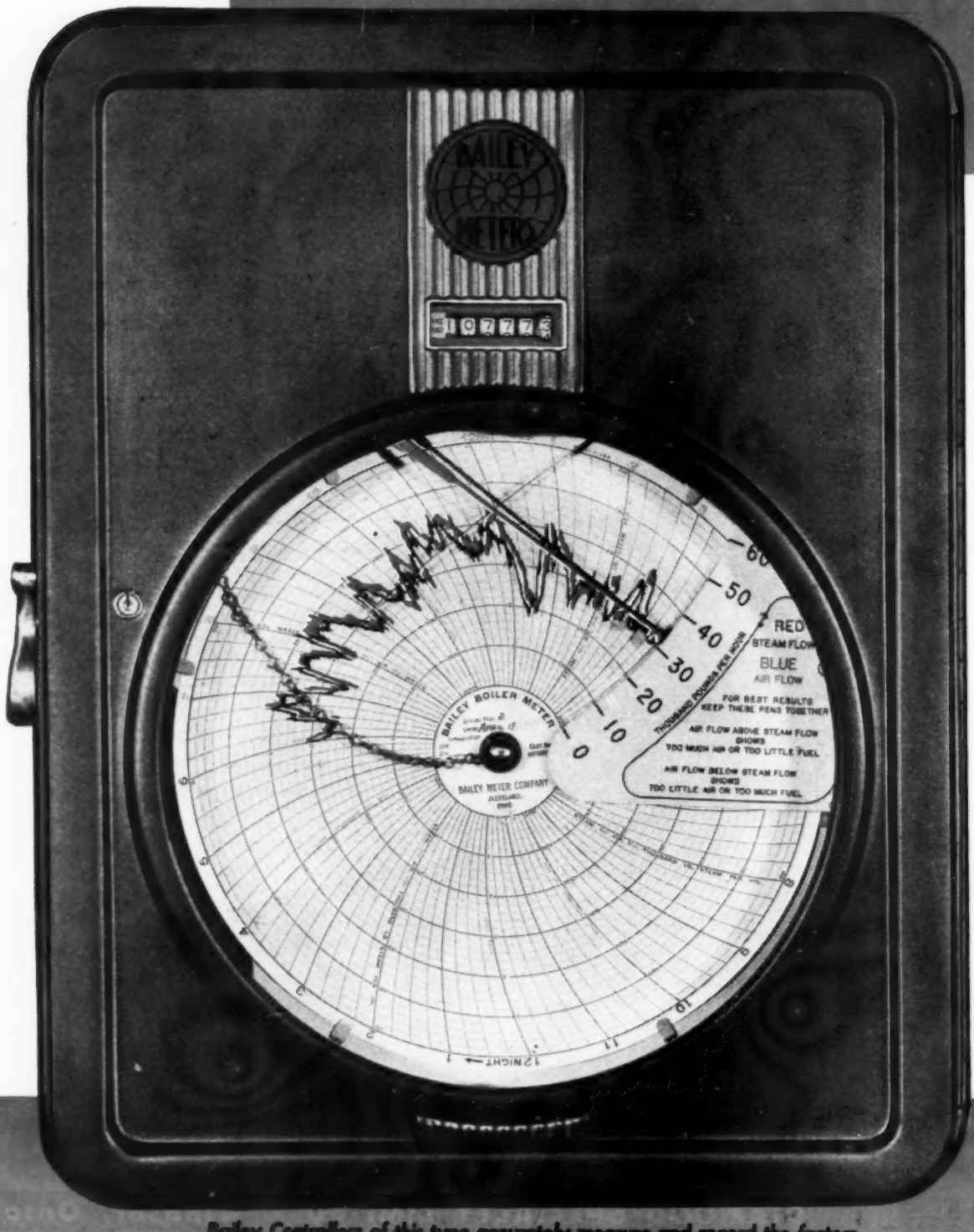
Experience on two 900,000 lb/hr boilers placed in operation in 1940 and one 900,000 lb/hr and one 550,000 lb/hr units installed in 1942 has proved the maintenance cost is unusally low.

Among the other advantages is the theoretically better cleaning with air from a given nozzle because of the greater density of air. If you are interested in further information, ask for Bulletin No. 956 which illustrates and describes an installation of Diamond Automatic Sequential Air Puff Blowers in a prominent eastern central station.

SPECIALTY CORP. • DETROIT 31, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

Whatever Fuel


BAILEY METERS
RED
STEAM FLOW
BLUE
AIR FLOW
FOR BEST RESULTS KEEP THESE PENS TOGETHER
AIR FLOW ABOVE STEAM FLOW SHOWS TOO MUCH AIR OR TOO LITTLE FUEL
AIR FLOW BELOW STEAM FLOW SHOWS TOO LITTLE AIR OR TOO MUCH FUEL
BAILEY BOILER METER
BAILEY METER COMPANY
CLEVELAND, OHIO
12 NIGHT

Bailey Controllers of this type accurately measure and record the factors upon which controls are based.

You Burn—You'll Save Money with BAILEY CONTROLS

You'll get high Economy, Safety and Availability because Bailey Controls, working from the accurate measurements of Bailey Meters, do the right thing at the right time.

Bailey Combustion Control

1. Secures instant response to changes in load by regulating both fuel and air at the same time.

2. Maintains optimum fuel-air ratio as measured by Bailey Meters.

3. Gives you the same complete control, when you change fuel, or even when you burn waste.

Bailey Three-element Feed Water Control

1. Reacts quickly and yet retains high stability by accurately measuring Steam Output and Feed Water Input and by controlling the rate of feed water input so that it equals steam output.

2. Surge resulting from severe load changes is held to a minimum by the action of flow ratio and level components which may be adjusted to conform with boiler characteristics and operating conditions.

3. Needs no excess pressure control because its operation is based in part on an accurate measurement of feed water input.

4. Power used by feed pumps may be reduced by applying Three-element Feed Water Control directly to pump speed.

Bailey Steam Temperature Control

Maintains uniform temperature by controlling primarily from boiler load and by readjusting from temperature.

Bailey Feed Heater Control

1. Gives smooth efficient flow through heaters because its multi-element action incorporates accurate measurements of both flow and level.

2. Permits the use of smaller storage capacity heaters and tanks thereby reducing the cost of initial equipment.

Bailey Pump By-Pass Control

Protects pumps by opening a by-pass valve when flow through the pump drops below the safe minimum value.

BAILEY METER COMPANY

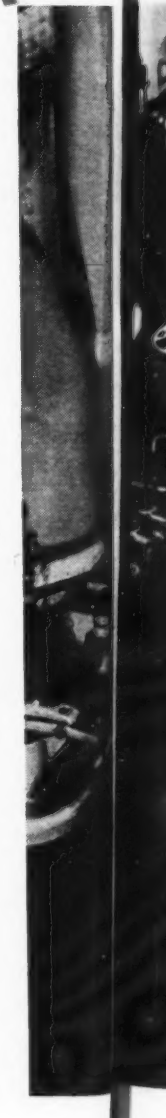
1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

A-99

CAMEL-POWER. NO LUBRICATION PROBLEM...



AN OCCASIONAL dab of lubricant — that's all a primitive machine needs. But *very special oils* are required for the modern turbine . . . oils that inhibit the formation of rust, sludge and foam . . . *Texaco Regal Oils (R & O).*

Regal Oils (R & O) are the long-famous Texaco Regal Oils *improved* by special rust and oxidation inhibitors. This means added ability to free themselves rapidly of air and water . . . to prevent the formation of sludge and rust — the latter especially important in new turbine installations.

Thus, *Texaco Regal Oils (R & O)* assure dependable turbine operation by keeping lubricating systems clean, bearing temperatures normal, and governor action smooth and responsive. *Regal Oils (R & O)* are approved by all leading turbine manufacturers and meet the turbine oil specifications of the U. S. Navy.

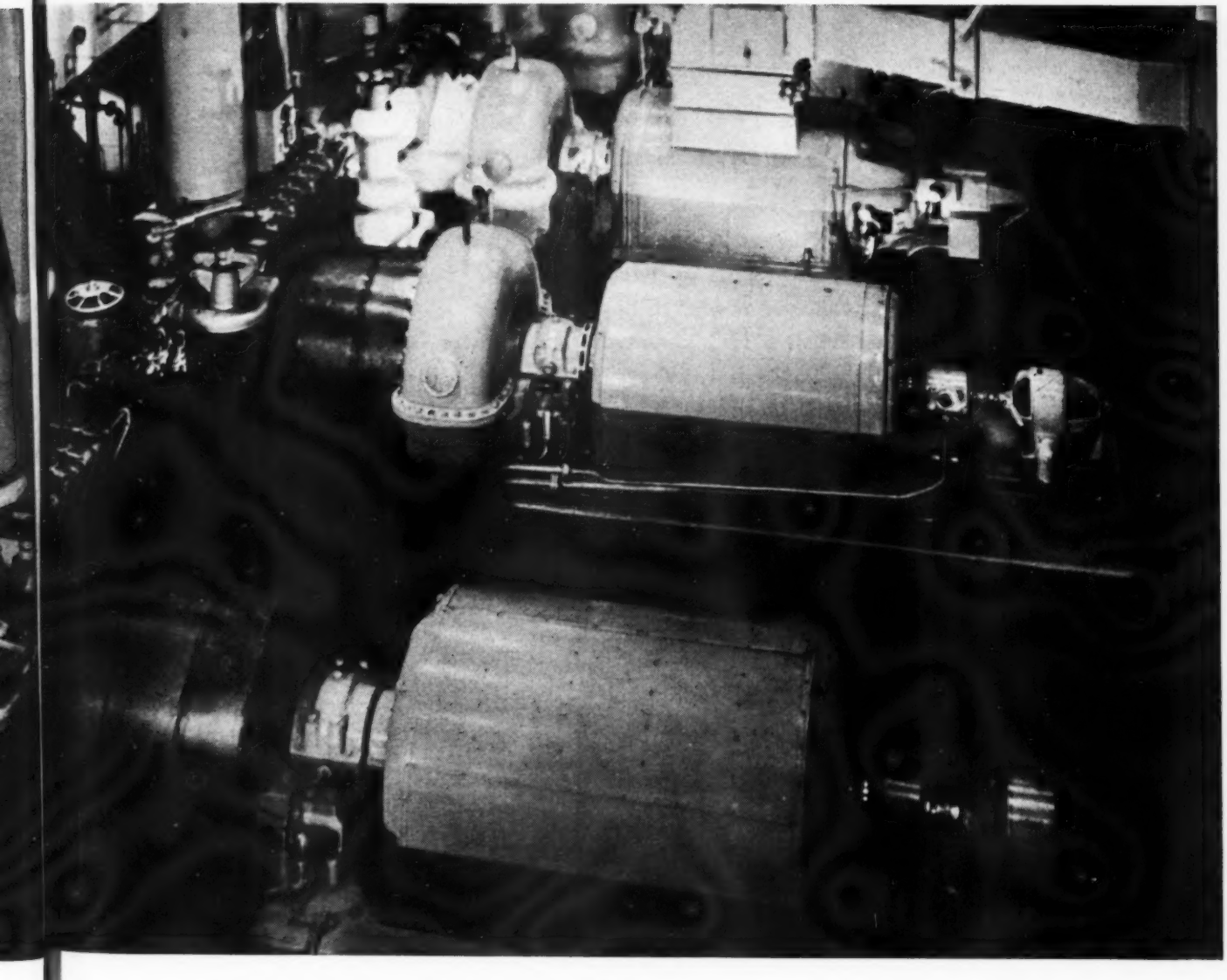
Regal Oils (R & O) and other Texaco lubricants for power plant use . . . as well as Texaco Lubrication Engineering Service . . . are available through more than 2300 Texaco distributing plants in the 48 States. Call the nearest one, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Tune in . . .
TEXACO STAR THEATRE
presents the NEW
EDDIE BRACKEN SHOW
every Sunday night.
Metropolitan Opera
broadcast every
Saturday afternoon.

TEXACO

TEXACO

BUT MODERN TURBINES REQUIRE SPECIAL LUBRICANTS



REGAL OILS (R & O)

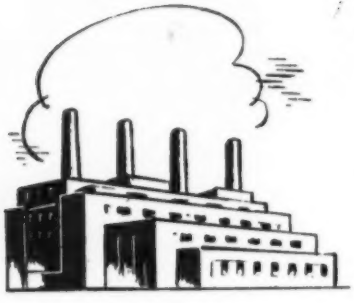
FOR ALL TURBINES

maintains FINENESS independent of wear

The degree of fineness of pulverized coal fired in a steam generator has a direct effect on overall boiler efficiency. Tests made by a public utility showed a gain of more than 4% in overall boiler plant efficiency when fineness was increased from 45% to 70%.* Any pulverizer which delivers high initial fineness but is unable to maintain it will be directly responsible for an efficiency drop. Therefore, it is essential that fineness be maintained at the level of new mill performance.

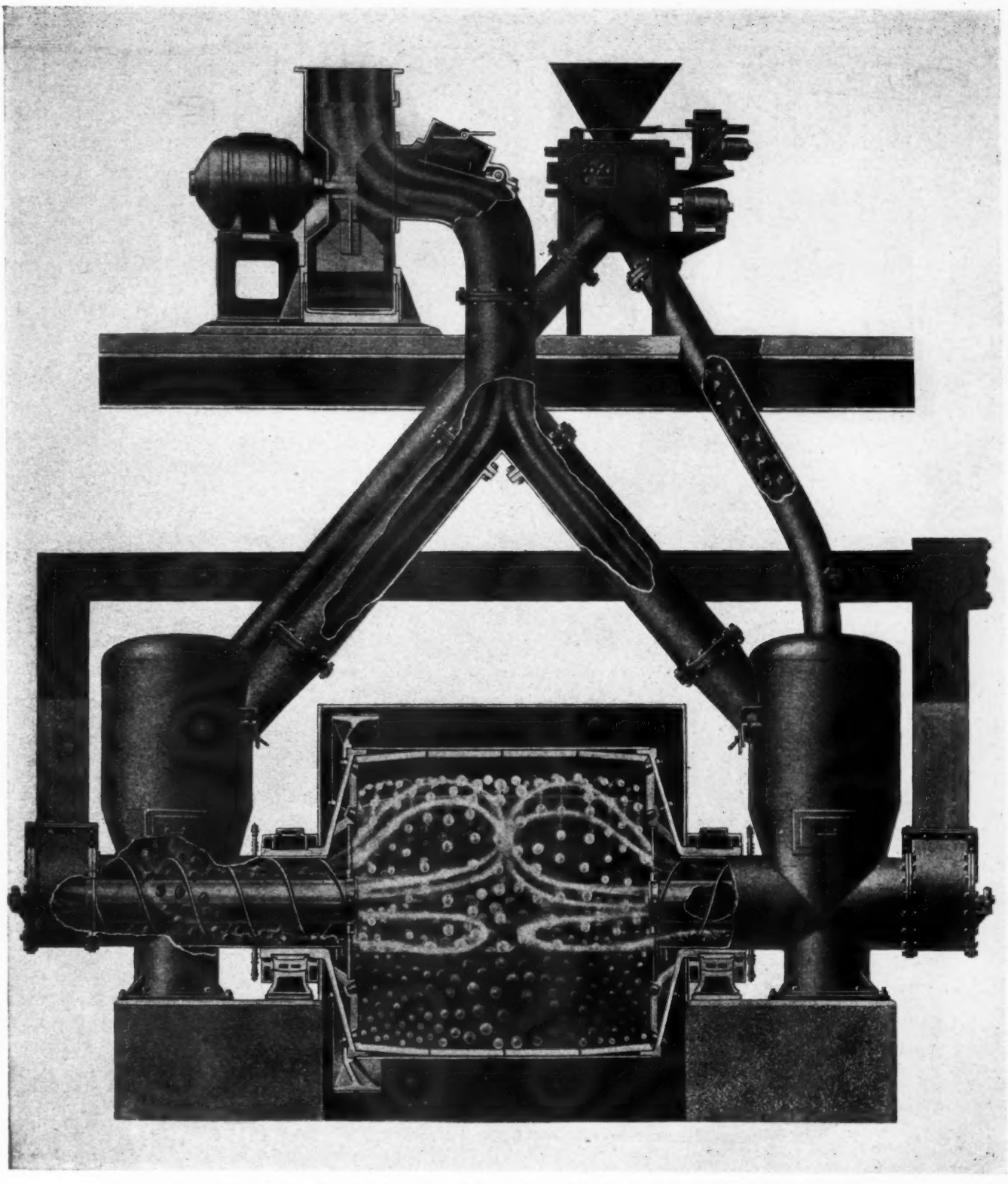
Continuous high fineness is maintained in FW pulverized fuel systems by periodic additions to the ball charge *while the mill is in operation.* The ball charge is the pulverizing agent, and the only wear which affects fineness is attrition of these steel balls. Since they can be renewed whenever necessary, fineness is controlled at all times *independent of wear.*

**ASME Transactions FSP, 54-7 Page 55*



BALL MILL PULVERIZERS GIVE YOU
CONTINUOUS HIGH FINENESS
HIGH AVAILABILITY (AVERAGES 99%)
LOW MAINTENANCE

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.

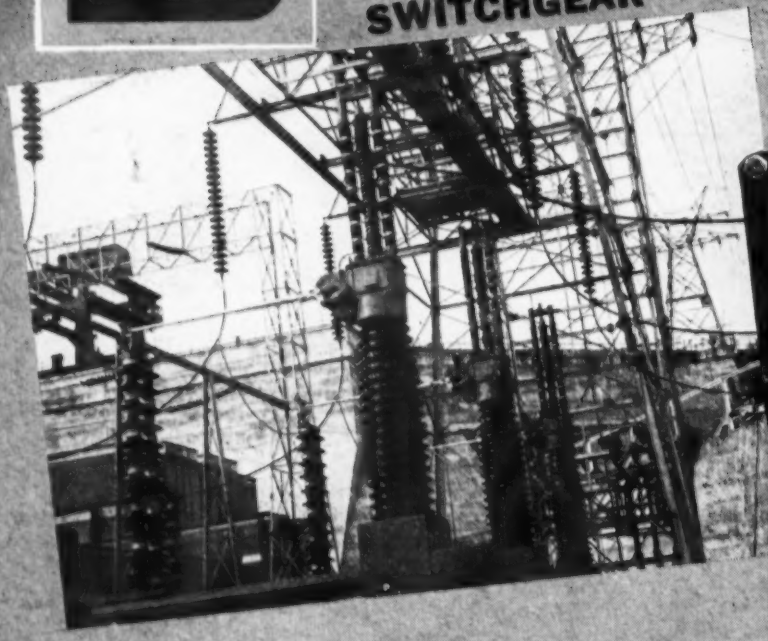


Important details of ball mill pulverizer operation are shown in this phantom drawing. As the conical mill revolves, heavy steel balls pulverize the fuel particles to the desired fineness. Air drawn through the mill by an exhauster picks up the powdered fuel and carries it in suspension through the classifiers, where any heavy particles drop out. These are returned to the mill, leaving only finely powdered fuel to be carried on to the burners. As the steel balls wear, a new charge is added while the mill is in operation.

FOSTER WHEELER

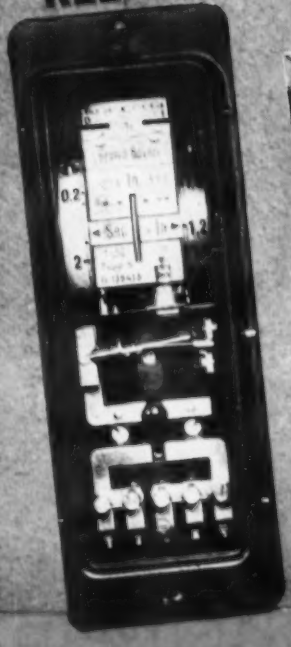
BROWN

SWITCHGEAR

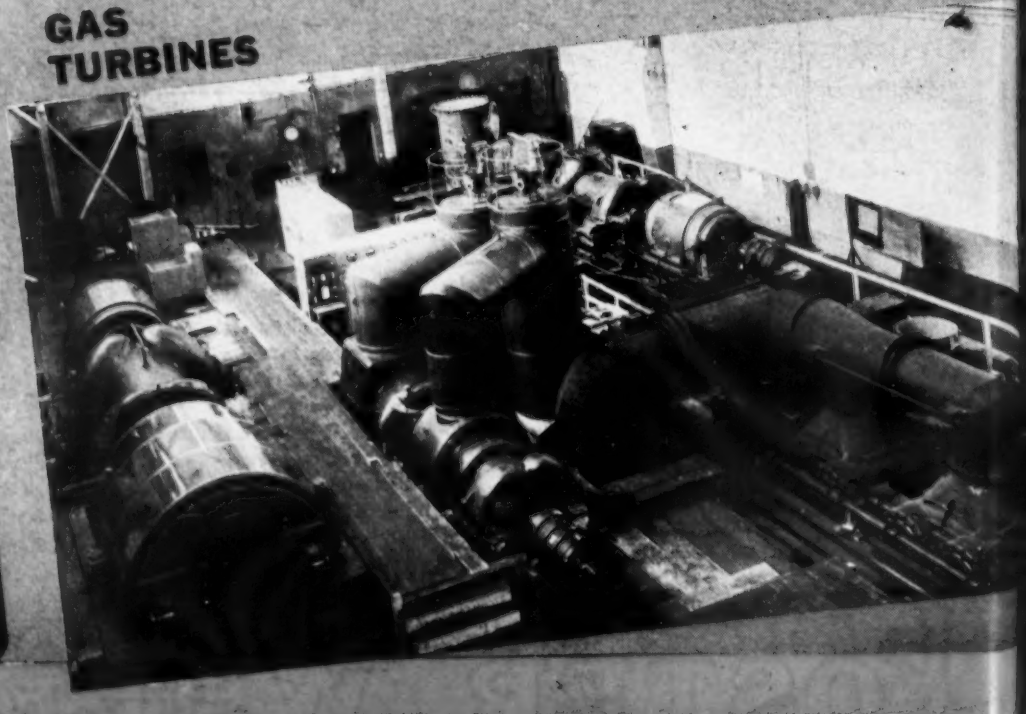


VOLTAGE REGULATORS

RELAYS



GAS TURBINES



BOVERI *in the* USA

SWITCHGEAR

Air-blast breakers, modern oilless, high-capacity, high-speed circuit breakers for highest transmission voltages — 220-kv breaker in a Canadian power system illustrated at left—down to medium and low distribution voltages, 30—20—10 kv. Rapid interruption, quick reclosing. Deliveries range upwards of two years.

VOLTAGE REGULATORS

Rocking-contact, automatic voltage regulators have beeen recognized for over 25 years as most reliable and economical. No wearing parts, require no adjustment and no maintenance. Same design elements in quick-acting regulators for current, power factor, frequency and automatic synchronizer. Soon available from New York stock.

RELAYS

Many designs answer a wide variety of needs: Primary and secondary maximum current relays for short circuit protection, with or without ammeter or current indication. Primary and secondary thermal relays for overload protection, with temperature indication. Differential and earth-leakage relays. Distance relays for selective protection of transmission systems.

GAS TURBINES

Brown Boveri built the first power unit, the first gas-turbine locomotive. Illustration at left shows 12,000-kw two-shaft unit for a peak-load plant in Rumania. Twelve units now on test or under construction include power units from 1500 to 27,000 kw, locomotive units of 2500 and 4000 hp, a converter blower unit for 25,000 cfm air delivery. Two-year delivery.

FOR more than five decades the name BROWN BOVERI has been identified, the world over, with aggressive and progressive engineering, with many "firsts" in the field of power generation, distribution and utilization. Sound engineering staff work, closely coordinated with skillful handiwork of master craftsmen, has produced machines and apparatus of highest dependability coupled with recognized accuracy and efficiency. BROWN BOVERI engineers introduced in the United States the automatic rocking-contact voltage regulator, the high-capacity steel-tank mercury-arc rectifier, the efficient blast-furnace turbo-blower without water cooling, the exhaust-gas-turbine supercharger for four-cycle diesel engines, and the gas-turbine axial-compressor unit for chemical process.

Production of these well-known BROWN BOVERI lines continues. World-wide operating experience is regularly translated into improvements and further perfection. New products have been developed—to do a given job more efficiently or faster—to afford a higher degree of reliability in operation—to give better protection for machines, transmission systems or power consumers. These products—old and new—are again available, in the proven BROWN BOVERI design, backed by the same engineering and research teams who developed them, and a steadily growing sales and service organization.

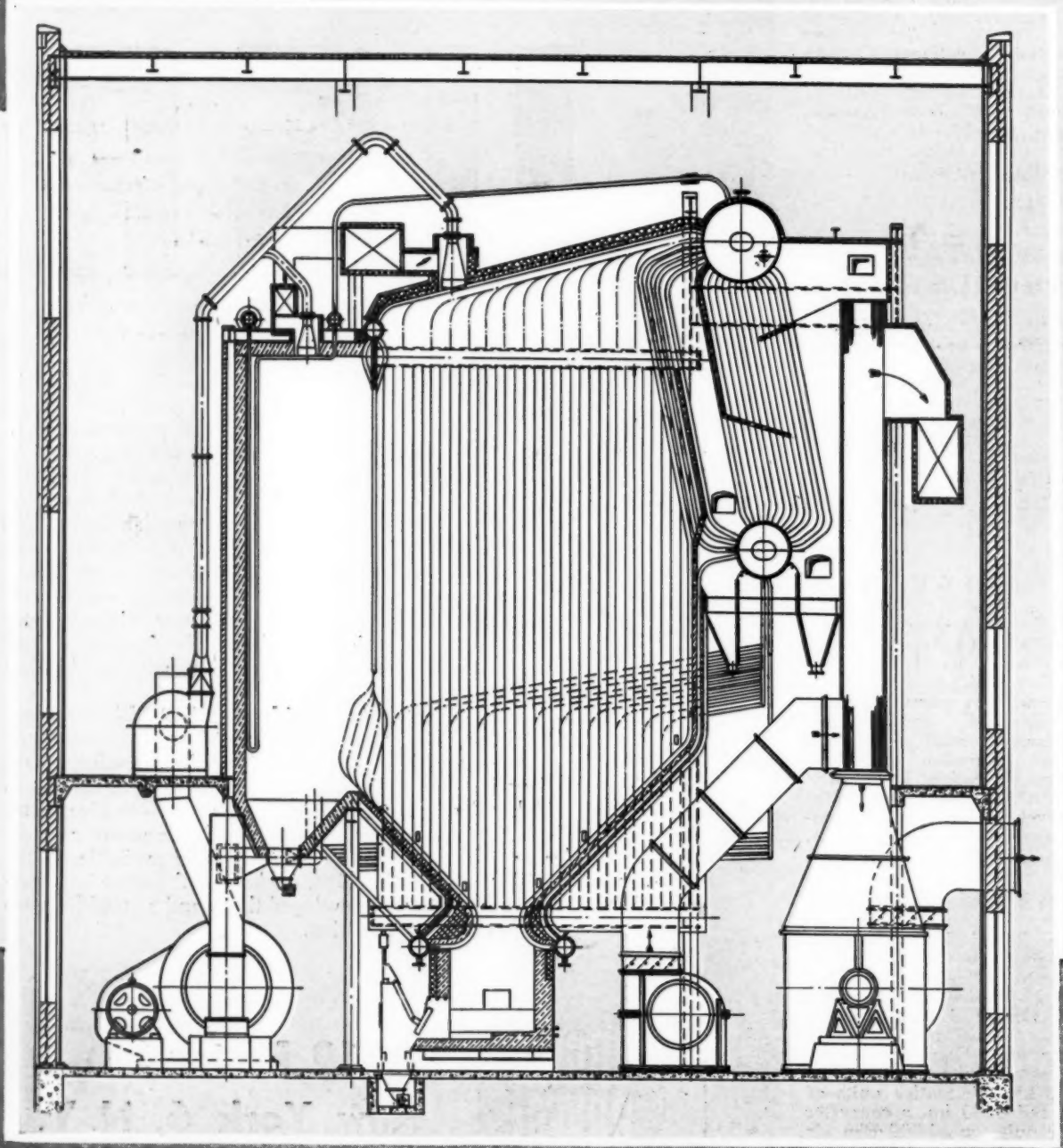
BROWN BOVERI

19 Rector St.
New York 6, N. Y.

KVS

ENGINEERING

anticipates tomorrow's needs



for ECONOMY...HIGH EFFICIENCY AND . . . LOW MAINTENANCE

Modern features of this complete, pulverized coal-fired steam-generating unit have been engineered by KVS to achieve over-all high efficiency on a wide range of coals and to assure close temperature control under practically all load conditions.

Accurate control of superheat and total steam temperature is provided by locating the superheater in a separate furnace fired by an individual burner. Varying heat output of this burner places in the operator's hands effective means of regulating steam temperature at any steam flow. Automatic regulation of fuel and air to burner makes possible the maintenance of uniform steam temperature over any range of load and under any load variation.

Proper coal pulverization for the combustion requirements involved in this design, is assured through the use of the Kennedy Air-Swept Tube Mill Pulverizer which provides a continuous, dependable supply of superfine pulverized coal regardless of the quality of coal available, and at lowest cost per ton of coal handled.

Units of this type can be furnished for any capacities, pressures or temperatures and are recommended for use with bituminous or anthracite coals.

KVS PRODUCTS

Boilers
Air-Swept Tube Mill Pulverizers
Fans
Air Preheaters
Superheaters
Economizers
Water Walls
Coal Elevators
Bunkers
Coal-Weighing Scales
Ash Conveyors

KVS ENGINEERING

Kennedy Van Saun offers a complete service for the design, building and furnishing complete, ready-to-operate steam generating plants including all necessary components. This service is available under one responsibility. Your steam requirements will have the prompt, careful attention of KVS Engineers.

Ask for KVS Bulletin No. 44-B containing valuable information on steam generation and on the application and use of pulverized coal to steam boilers.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVENUE • NEW YORK 16, N. Y.
FACTORIES: DANVILLE, PA.
CANADA • ENGLAND • FRANCE • AUSTRALIA

It's time to MODERNIZE

No old stoker can match the efficiency dependability of the modern Iron

OBSOLETE STOKERS HAVE THESE EARMARKS

HIGH FUEL COSTS

Many old stokers are trying to carry increased loads by using premium coals. Others lack the precision control of fuel and air for most efficient combustion. Coke in ash is a visible evidence of fuel waste, of which many out-moded stokers are guilty. Iron Fireman engineers will analyze your fuel costs without charge.

EXCESSIVE STACK LOSSES

Although smoke is one evidence of stack loss, some of the most serious wastes occur in smokeless stacks. Out-moded stokers cannot control the combustion processes with sufficient precision to prevent high stack losses. Iron Fireman tests will reveal how much you are paying for such losses.

LOW BOILER OUTPUT

Most old stokers are unable to produce the steam output of which the boiler itself is capable. There may be several contributing causes besides the inadequacy of the stoker, such as poor draft conditions, improper installation, etc. Iron Fireman has successfully replaced hundreds of stokers where greater boiler capacity was required.

WASTED BOILER ROOM LABOR

Many old stokers waste man hours because they have high hoppers that are hard to fill. In some cases hoppers and mechanism overhang fire doors, making fire cleaning difficult. Also mechanism that is hard to reach or located in areas of intense heat add to labor costs. Iron Fireman Coal-Flow models feed from main bunker, have no boiler front obstructions, no inaccessible machinery.

HIGH FURNACE AND STOKER MAINTENANCE

Watch your repair bills—they may be a warning. An undependable stoker, quite beyond its maintenance cost, may cause losses that amount almost to havoc when stoker breakdown or burned out furnace lining forces a plant shut-down. It is *never* profitable to let a stoker die of old age.

TIME LAG IN LOAD PICK-UP

Stokers that are not readily responsive to load demands are not only a drag on the whole plant—they are fuel wasters. Iron Fireman stokers, in both the underfeed and pneumatic spreader types, preheat the coal and add both fuel and air without disrupting the fuel bed, and are therefore highly sensitive to load changes.

WITH all fuels rising in cost, Iron Fireman stokers enjoy an outstanding advantage in their ability to burn a wide range of coals, permitting the efficient use of whatever type is most economically supplied by the local market.

Iron Fireman's efficient conveying system not only saves boiler room labor, but often saves large investments in coal handling equipment. Its adaptability to existing boiler room layouts avoids costly alterations.

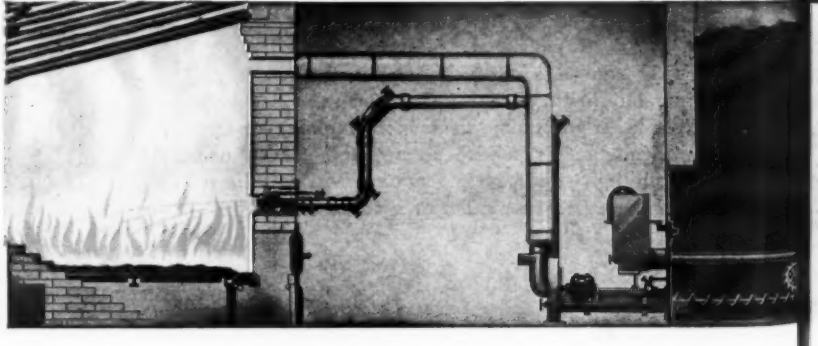
Iron Fireman's instant responsiveness to load variations, and its automatic, continuous control of the fuel-air ratio make the modern Iron Fireman a great fuel saver.

Iron Fireman's exceptional dependability, (which is another word for low maintenance cost) is due to sturdy construction, easy accessibility, and separation of all mechanical parts from destructive furnace heat.

Iron Fireman's nation-wide organization assures an engineered installation, carefully planned in each individual case to get maximum efficiency from your boiler. A routine result of an Iron Fireman installation is increased boiler capacity.

How the IRON FIREMAN Pneumatic Spreader stoker operates

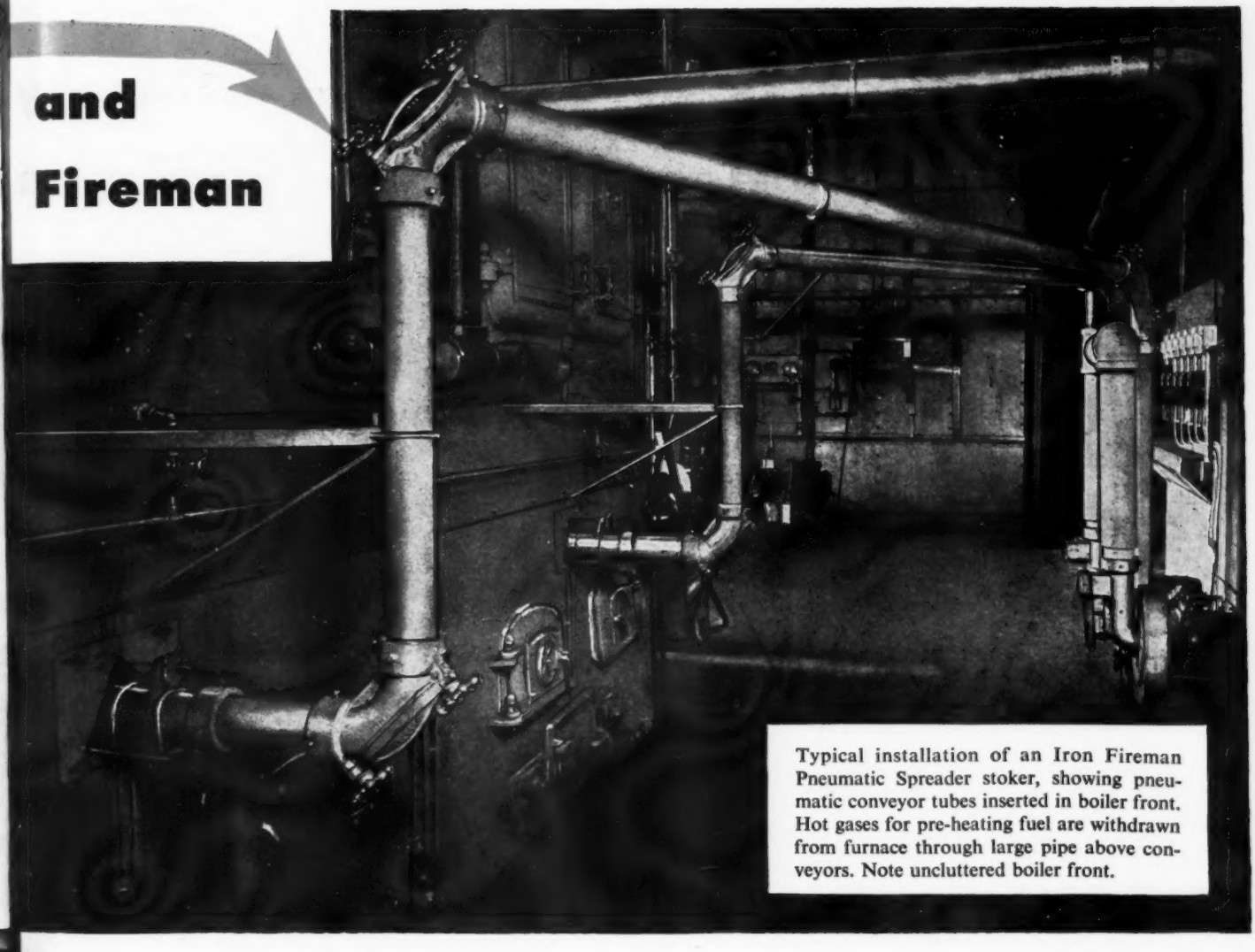
The Iron Fireman Pneumatic Spreader Stoker meters steam size coal from hopper or main coal bunker to transfer housing, where coal is picked up by pneumatic conveyor and delivered to furnace. The conveyor nozzle accurately spreads the larger particles of coal over the entire grate in a shallow, uniform fuel bed. The preheated fines burn in suspension, reducing the cinder carry-over and greatly improving the combustion efficiency and responsiveness, as compared with other stokers which to not preheat fuel.



Heavy Duty Automatic Coal Stoker for Power, Processing and Heating

with an IRON FIREMAN stoker

and Fireman



Typical installation of an Iron Fireman Pneumatic Spreader stoker, showing pneumatic conveyor tubes inserted in boiler front. Hot gases for pre-heating fuel are withdrawn from furnace through large pipe above conveyors. Note uncluttered boiler front.

Do you KNOW what your steam costs are?

Here's how to find out . . . The first step toward reducing steam costs is to know exactly what your costs are now. Iron Fireman engineers are fully equipped to make a factual study of your boiler room operations. They can measure your stack losses, determine the efficiency of your boilers, make a scientific appraisal of stoker and furnace, and tell you how much of the fuel you buy is wasted and how much you are able to apply as usable heat. Their study will also show what an engineered Iron Fireman installation will accomplish in your present boiler.

This service is performed without expense or obligation on your part. Iron Fireman's engineering, sales and service organization covers the continent. Write for engineering survey or for literature to Iron Fireman Mfg. Co., 3102 W. 106th St., Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada. Stokers for every size and type of firing job.

IRON FIREMAN

THE IRON FIREMAN

Buss Fusetrons

Keep Circuits Operating
Prevent Costly Shutdowns

Reduce Heating

In Panelboards and Switches

Here's Proof

"We have a battery of five electric furnaces, with automatic controls cutting in and out frequently. When each furnace circuit was protected by a 100 ampere renewable fuse, we averaged one fuse outage weekly on each unit. The fuses were running very hot even though extreme care was exercised to maintain clean clips and good contact, with periodic checkups.

"On May 8, 1945, our chief electrician installed 100 ampere Fusetrons in these circuits. In the first three months after that, not one blew. As this electrician puts it, 'I can now go home at night without that continual fear that I'll be called up in the middle of the night to make a fuse replacement on one of those furnace circuits, something that used to happen entirely too often.' Our manager is naturally pleased by the elimination of those five furnace shutdowns every week, each one involving the possible loss of the contents of the furnace, and always resulting in high priced labor standing around waiting for burned out fuses to be replaced."

A Large Manufacturer in Wisconsin
(*name on request*)

...Sold Through Wholesalers **BUSS**

Cooler Operation of Switches and Panels with Fusetrons Reduces Needless Blowing of Fuses

Switches and panelboards stay cooler with Fusetrons—because Fusetrons have very much less resistance than ordinary fuses. Since heat produced by the flow of current is proportional to resistance—Fusetrons generate very much less heat than ordinary fuses.

This cooler operation means the elimination of needless blows and useless shutdowns that are the result of heating in fuses.

Cooler operation also adds to the life of switches and panelboards.

LOOK at the Resistance of Fusetrons compared to the Lowest Resistance Fuse

Chart shows resistance at full load in ohms.

Notice that fuses have 55 to 140% greater resistance than Fusetrons. That is why Fusetrons reduce heating—keep circuits in operation—prevent costly shutdowns.

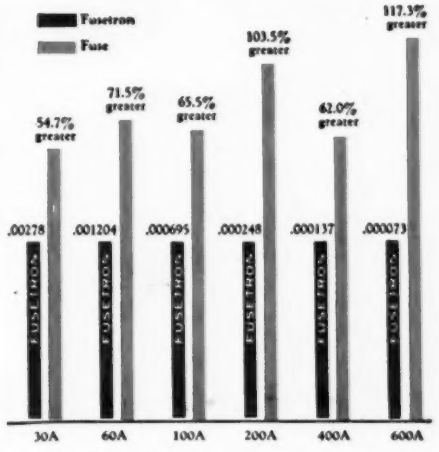


Chart shows 250 volt sizes. 600 volt sizes show similar results.

Fusetrons Give Many Other Kinds of Protection Heretofore Not Available

What Is the Fusetron?

The Fusetron is a dual element device—a fuse to which is added a thermal cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratory approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in tamper-resisting type (Fustats) for 125 volt circuits.

Their cost is surprisingly low.

Fusetrons do everything fuses do, as is confirmed by the Underwriters' Laboratories' Label, and in addition

★ Provide simplest way to stop burnouts from single phasing. ★ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads. ★ Give thermal protection to panel boards and switches. ★ Prevent needless blows caused by heating in panels and switches. ★ Protect motors against burnout. ★ Give double burnout protection to large motors. ★ Make burnout protection of small motors simple and inexpensive. ★ Permit use of larger motor or adding more motors on circuit without installing larger switch or panel. ★ On new installations, proper size switches and panels can be used instead of oversize. ★ Protect coils, transformers and solenoids against burnout.

Get All The Facts • Get Better Protection

Send the Coupon Now

One needless shutdown—one destroyed switch or panel—one burned out motor may cost you far more than replacing every fuse with a FUSETRON.

Don't risk such losses—protect your production schedules by changing over your entire electrical system to FUSETRONS.

Bussmann Mfg. Co., University at Jefferson 347
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about BUSS Fusetrons.

Name_____

Title_____

Company_____

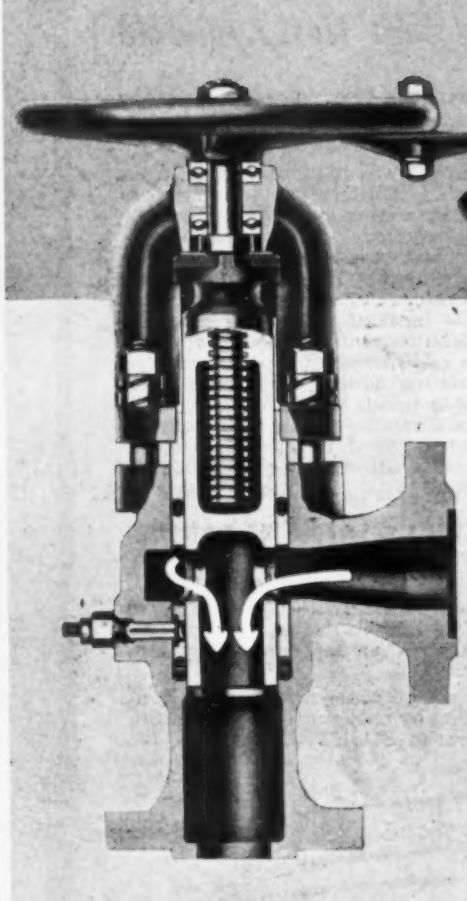
Address_____

City_____ State_____

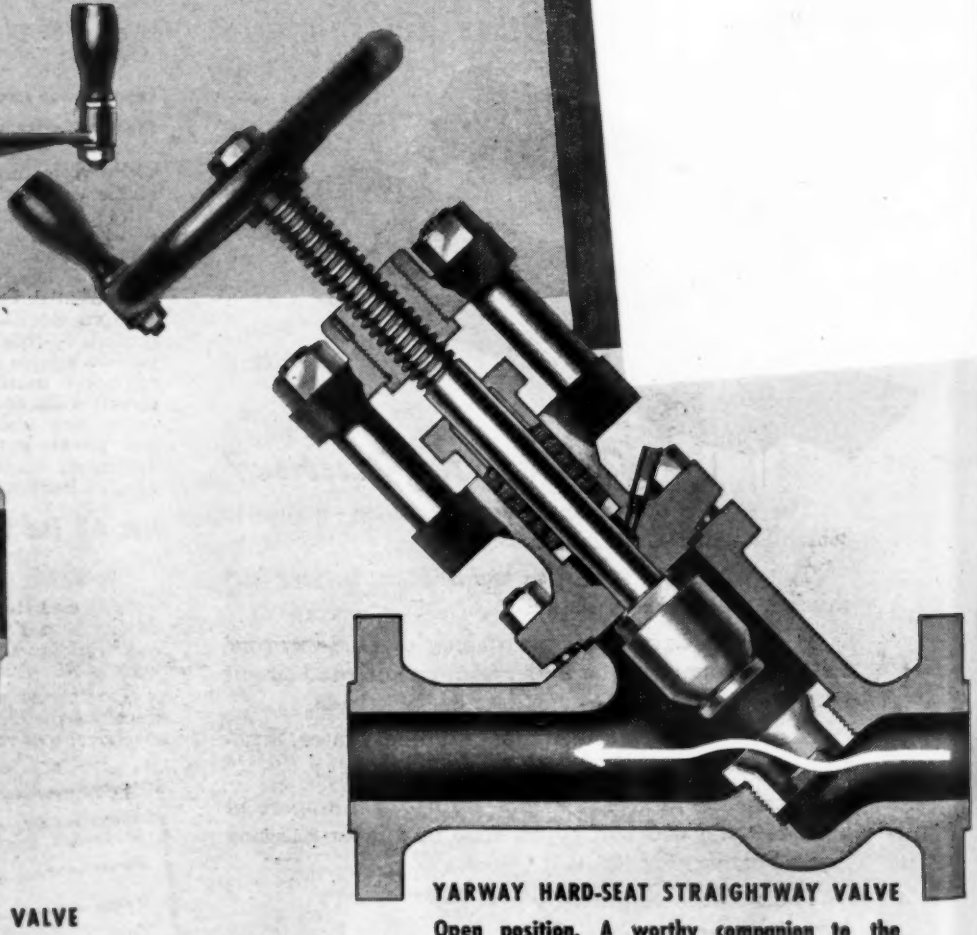
FUSETRONS

4

HIGH PRESSURE BOILER PLANTS



YARWAY TYPE "C" SEATLESS ANGLE VALVE
Open position. Notice balanced sliding plunger design. For pressures from 400 to 2500 psi.



YARWAY HARD-SEAT STRAIGHTWAY VALVE
Open position. A worthy companion to the Yarway Seatless Valve for tandem use on higher pressures. For pressures from 400 to 2500 psi.

YARWAY

OUT OF 5

USE YARWAY BLOW-OFF VALVES

It's a fact! Four out of every five high pressure boiler plants in the United States are equipped with Yarway Blow-Off Valves.

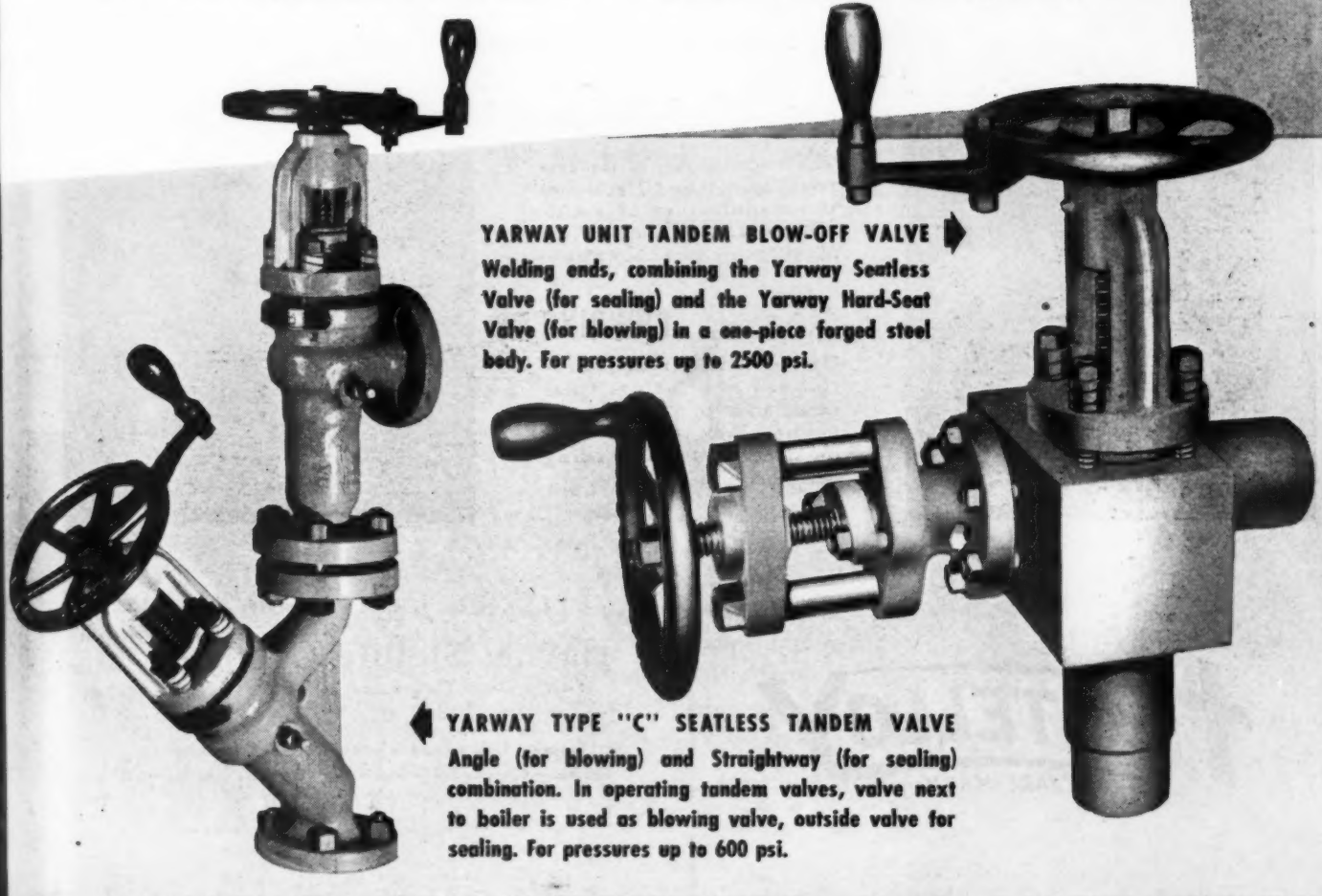
Why such an overwhelming acceptance? *Dependable performance.*

The proved performance of Yarway Blow-Off Valves is due to outstanding design, sound engineering and careful manufacture.

The famed Yarway *Seatless* principle eliminates a major source of blow-off valve trouble. Yarway Seatless Valves have no seat to score, wear, clog and leak. And constant research, leading to mechanical and metallurgical advancements, keeps Yarway valves ever ahead of changing service requirements.

Next time you order blow-off valves, remember—power engineers vote 4 to 1 for Yarways. You'll find all the details in Yarway Bulletin B-432.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.



YARWAY UNIT TANDEM BLOW-OFF VALVE
Welding ends, combining the Yarway Seatless Valve (for sealing) and the Yarway Hard-Seat Valve (for blowing) in a one-piece forged steel body. For pressures up to 2500 psi.

YARWAY TYPE "C" SEATLESS TANDEM VALVE
Angle (for blowing) and Straightway (for sealing) combination. In operating tandem valves, valve next to boiler is used as blowing valve, outside valve for sealing. For pressures up to 600 psi.

BLOW-OFF VALVES

HASTELLOY TRADE-MARK Alloy is Readily Fabricated

High-strength HASTELLOY alloy is widely used throughout the chemical industry because of its outstanding resistance to severely corrosive media. It is available in standard mill forms that can be fabricated by most usual methods. For information on properties, forms, and applications, write to any district office.

OXY-ACETYLENE WELDING

HASTELLOY alloy processing equipment can be readily fabricated by oxy-acetylene welding. Here a flange is being welded on a HASTELLOY alloy tank outlet.

ELECTRIC ARC WELDING

Large equipment made of HASTELLOY alloy is assembled by metallic arc, atomic hydrogen, or HELIARC welding. Shown here is a 1,000-lb. water jacketed cooler inlet sleeve for handling sulphur dioxide solutions.

MACHINING

The machinability of HASTELLOY alloys A, B, and C facilitates the manufacture of a wide variety of parts such as the alloy C pump back shown here.

GRINDING

HASTELLOY alloy D can best be finished by grinding. These small alloy D pins are being finished to very close tolerances on a centerless grinding machine.

HASTELLOY TRADE-MARK

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago — Cleveland — Detroit — Houston — Los Angeles — New York — San Francisco — Tulsa

"Hastelloy" and "Heliarc" are registered trade-marks of Units of Union Carbide and Carbon Corporation

this cable won't quit when jobs are HOT!

Wiring in high-temperature locations is vital to steady plant operation. If a power cable quits, if a control circuit fails, it may ruin a "heat" or close down a department.

For years, plant engineers with hot jobs to wire have specified Deltabeston* power cable and boiler-room wire. They recognize the practical application experience which General Electric has been able to put behind them. They know that new research is always under way.

In many cases, too, it's the selection of the right *type* of heat-resistant cable that's so important to long life. The Deltabeston line includes standards and "specials" for every combination of heat, moisture, corrosive vapor or other condition. And *men who know the problem* stand back of your Deltabeston supply source, ready to advise you or your contractor on selection. For full information on Deltabeston cables or wires for *any* hot job, write Section Y53-363, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

**Trade-mark Reg. U. S. Pat. Off.*

GENERAL ELECTRIC

HI-AMBIENTS

Practical product suggestions from your Deltabeston Distributor

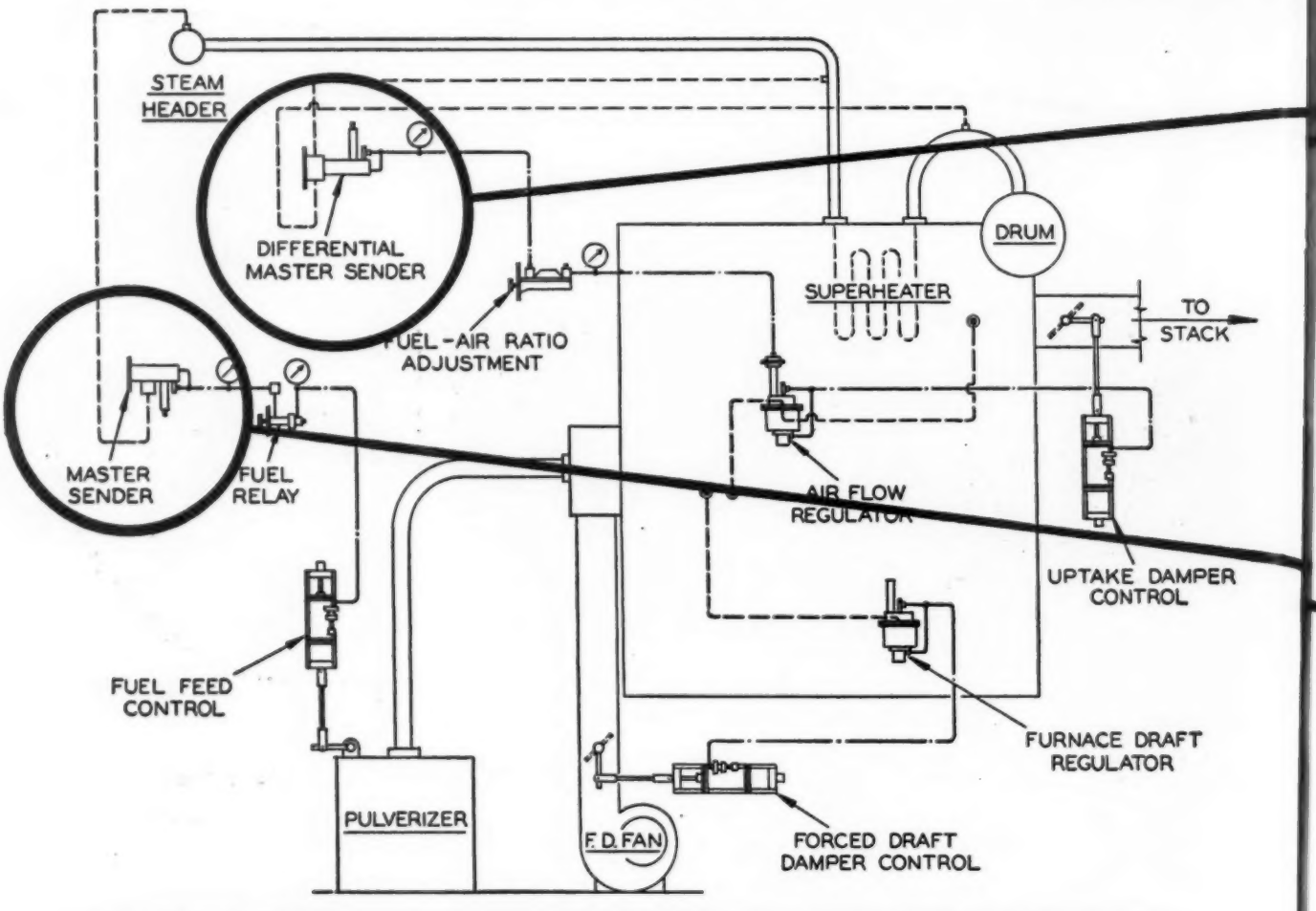
FOR FLEXIBLE LEADS . . . on heavy apparatus that involves hot work, such as electric furnaces, cranes handling hot metals, and the like, Deltabeston YK-2253 is a popular choice. Insulated with an impregnated wall of felted asbestos and asbestos braid, it resists heat, flame, oil and corrosive vapors up to 125 C (257 F).

IF YOU ARE PUZZLED . . . as to the relative merits of asbestos-insulated versus glass-insulated magnet wire for any particular application, you can get unbiased advice from Deltabeston application specialists. The Deltabeston line includes both. And for extra severe jobs, glass-insulated wire with *silicone varnish* is now becoming available. Its rating is 200 C.

FLUORESCENT FIXTURES . . . need heat-resistant wiring in and around the ballast. For those located in hot, humid places, *all* the wiring should be heat resistant. Why not make your installation with the same type of Deltabeston wire which ballast and fixture manufacturers use?

WIRING JET PLANES . . . may be a long way from your business, but the choice of a Deltabeston Aircraft Wire for this extra-severe duty helps explain why so many folks turn to us for solutions to "impossible" insulation requirements.

DELTABESTON
Wires and Cables
Built to beat the heat



SIMPLE . . . DIRECT . . . ACCURATE

Hagan Differential Master Method of automatic combustion control

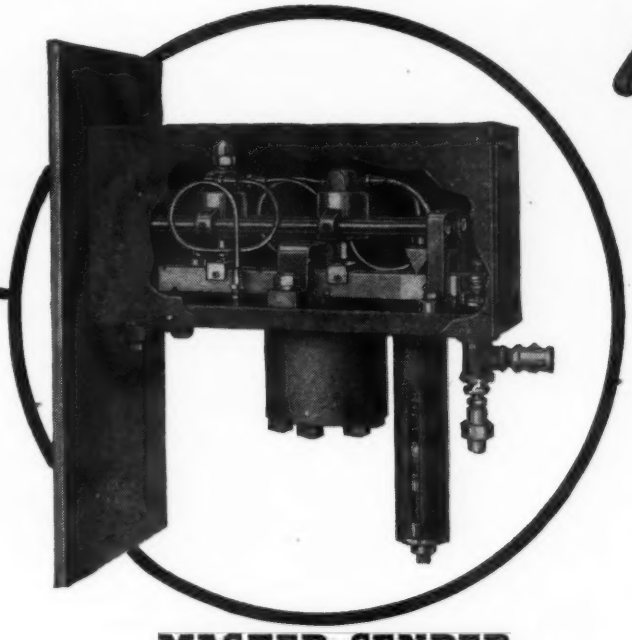
In the firing of pulverized coal, the accurate maintenance of fuel-air ratio has been hampered by such factors as variation in the calorific value of coal, and coal feed mechanisms which are affected by moisture content and coal size.

The Hagan Differential Master method of combustion control automatically maintains proper combustion conditions in a simple and direct way, using the boiler unit itself as a calorimeter of heat input.

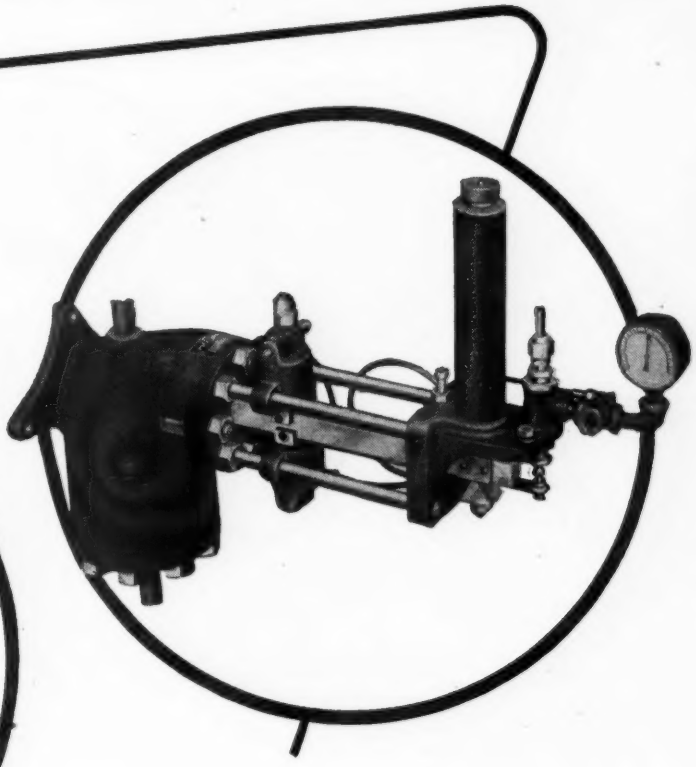
A Master Sender, sensitive to steam header pressure, controls the rate of fuel feed so that B.t.u. input is in accordance with demand.

A Differential Master Sender, measuring steam flow, regulates air flow.

These units are not interconnected; each has its



MASTER SENDER



DIFFERENTIAL MASTER SENDER

own function, and performs that function *directly*. The rate of fuel feed is changed instantly to compensate for any change in steam demand, or variation in calorific value of fuel or in feeder characteristic. Air, however, is changed only when there is an actual change in steam flow.

Control is direct and accurate—there is no necessity for approximate adjustment, to be corrected by a lagging corrector system.

Tested in Service

The Differential Master method has been thoroughly tested in service. In the past four years it has been applied to boilers burning oil, gas, and pulverized coal, and to multiple fuel boilers. Boiler sizes ranged from 30,000 lbs./hr. at 200 p.s.i. to 650,000 lbs./hr. at 1800 p.s.i. In every instance, results have been entirely satisfactory.

Substantial Fuel Savings

Where the differential master sender can be applied, it gives better control of combustion and substantial savings in fuel. Our engineers will be glad to discuss its possibilities in your plant.

HAGAN CORPORATION, HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

HAGAN
HALL
BUROMIN
CALGON

C-E has no axe to grind

A complete line removes any bias in favor of a particular type. C-E offers you the most complete line of stokers available today . . . a line that meets every requirement of fuel, capacity and load conditions in commercial heating, industrial and power generation fields. This freedom of choice, *offered you by C-E alone,* has substantial advantages. Among the most important of these is the assurance of obtaining the equipment best suited to your specific requirements, as determined by experienced, *impartial* investigation.

Each of the basic types here illustrated is the result of fifty years of experience in stoker design and application . . . and, more than that, each type reflects the practical knowledge of fuels and operating conditions C-E has acquired in installing more than 19,000 stokers.

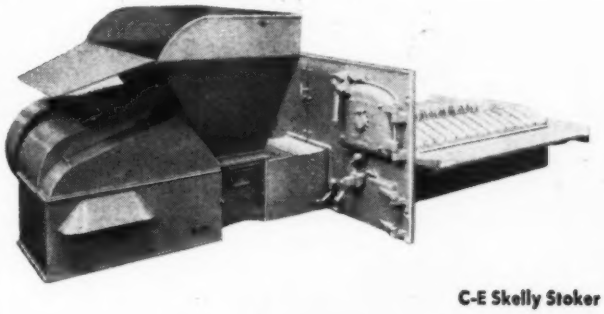
Since the cost of fuel burned on a stoker in a single year greatly exceeds the initial cost of the stoker itself, it is evident that the performance a stoker will give is a far more important consideration than the purchase price. Top performance will continue to pay dividends on your stoker investment long after the purchase price is forgotten.

You can assure yourself of top performance by coming to C-E — *stoker headquarters* — for assistance when you are in the market for stokers. You will gain materially by using the service of a manufacturer who has no axe to grind! B 120

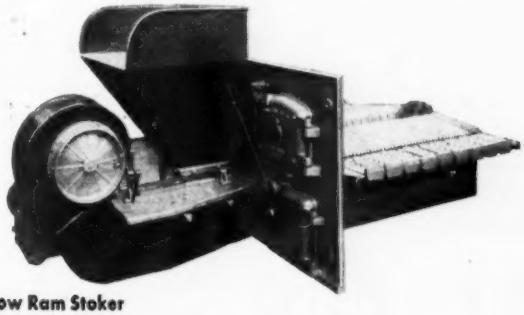
C-E

COMBUSTION

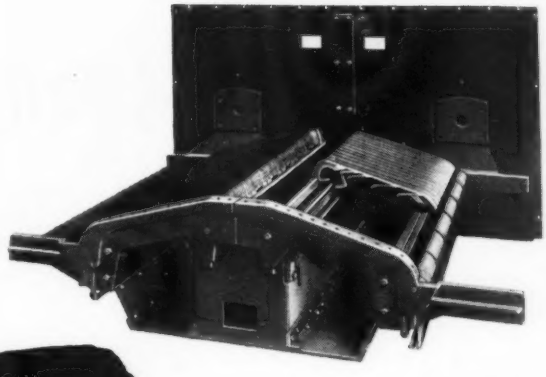
C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



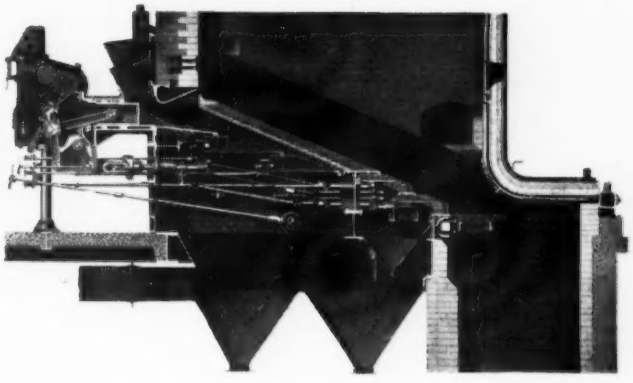
C-E Skelly Stoker



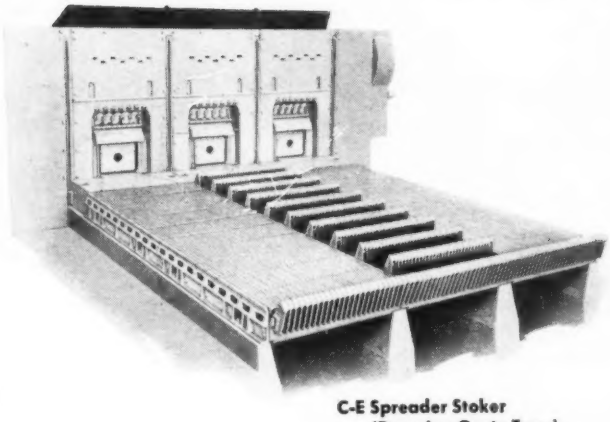
C-E Low Ram Stoker



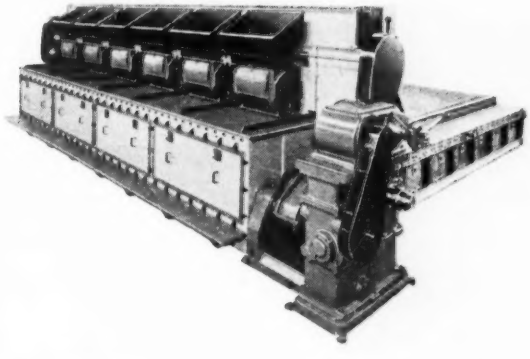
C-E Type E Stoker



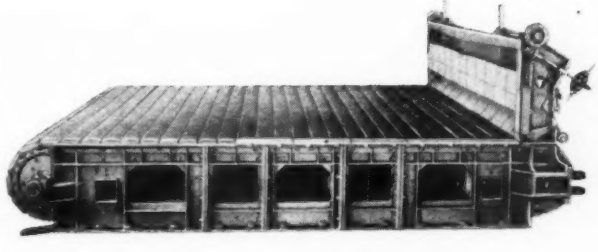
C-E Multiple Retort Stoker



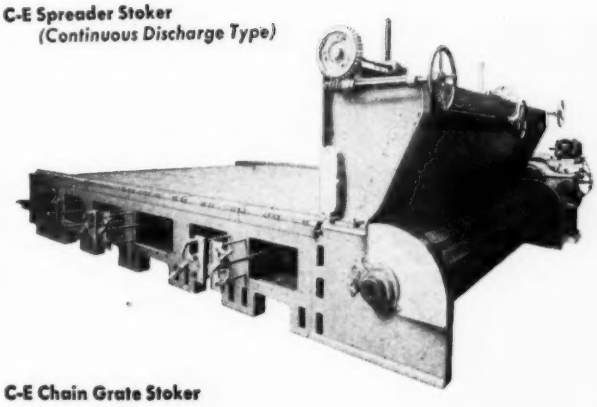
C-E Spreader Stoker
(Dumping Grate Type)



C-E Spreader Stoker
(Continuous Discharge Type)



C-E Traveling Grate Stoker



C-E Chain Grate Stoker

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

Scovill Tube News

Vol. 5 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 1

1,240,000 Pounds of Scovill Tubes at Cities Service Lake Charles Plant

In order to process the daily average of 80,000 barrels of crude oil required to meet its wartime assignment for the production of high octane gasoline and butadiene, the Cities Service Refining Corporation's plant at Lake Charles, Louisiana, required heat exchanger tubes which could be depended upon for maximum efficiency and a minimum of maintenance and replacement.

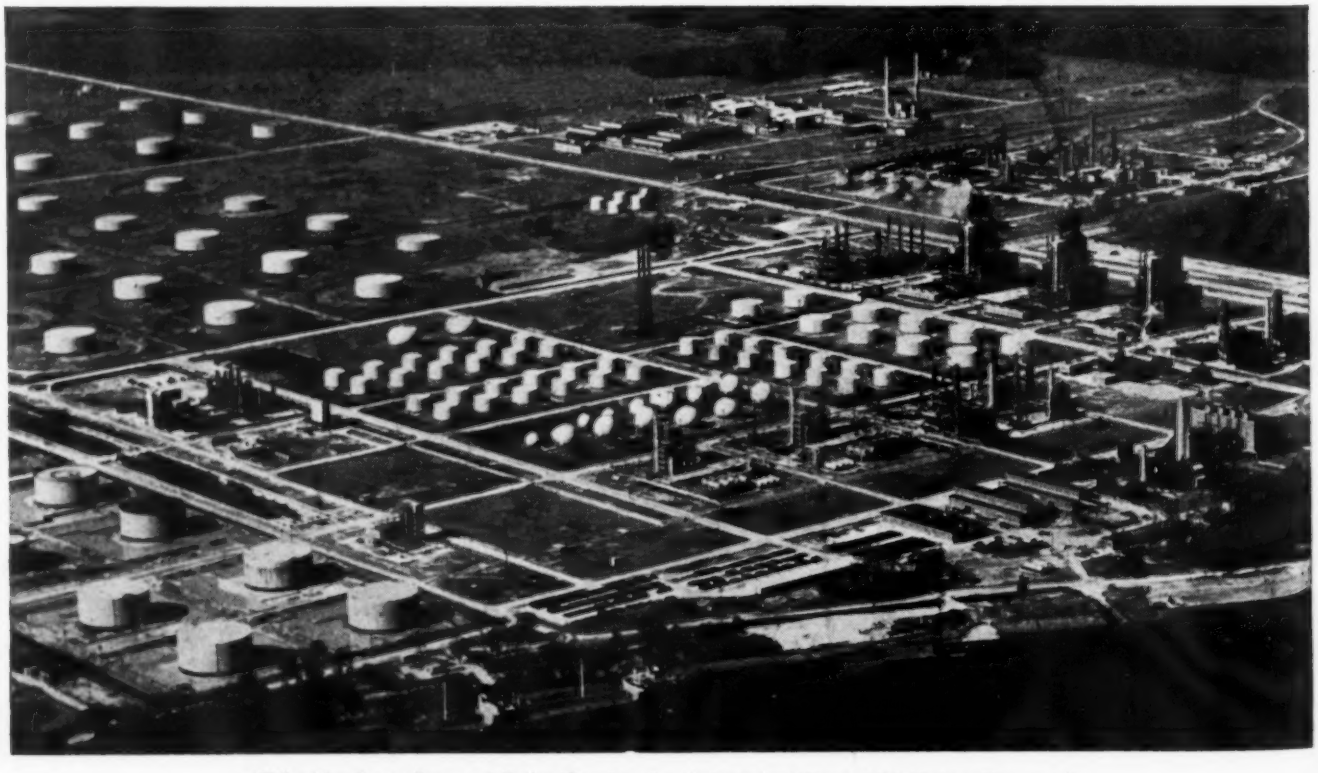
A total of 1,240,000 pounds of Scovill Heat Exchanger Tubes serves various units of this plant, now devoted to the production of gasoline, kerosene and fuel oils.

The plant's principal equipment consists of three fluid catalytic cracking units and one thermal cracking unit with supplementary alkylation and isomerization units, crude distillation and treating and finishing units.

Operating conditions indicated the advisability of selecting Scovill's Phosphorized Admiralty tubes.

These conditions include:

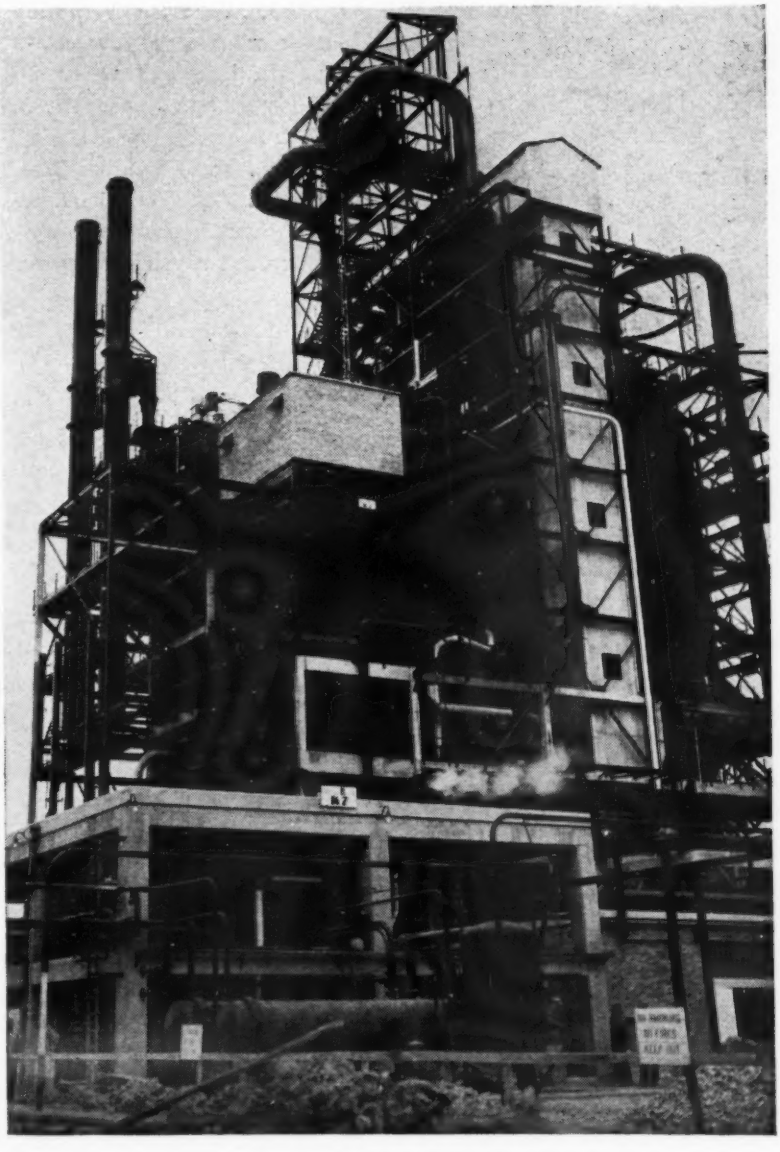
Temperature inside tubes. . 125°F.
Temperature outside tubes. . 250°F.–300°F.
Velocity of flow inside tubes. . 2–3.5 ft. per second.
Vibratory stresses present in catalytic cracking units.



Cities Service refinery at Lake Charles, La. (photo by Elwood M. Paine, Houston)

The medium outside the tubes consists of hydrocarbons carrying small quantities of hydrogen sulphide and traces of ammonium chloride and ammonium sulphide.

The medium inside the tubes is water taken from the Calcasieu River. For about six months the chlorides are low—about 3 p.p.m.—but the water is contaminated with swamp acids, resulting in a pH of about 6.5. During the other six months, the chlorides rise to about 500 p.p.m., due to tidewater contamination, and the pH rises to 7.3. Oxygen concentration is from 4 to 6 p.p.m.



One of the Fluid Catalytic Cracking Units at Cities Service Lake Charles Plant

THREE SCOVILL SERVICES

Service in Manuals, of which "Scovill Tube News" is a sample, consists of literature providing the latest, most authentic information* on condenser and heat exchanger tubes, which has its source in the broad experience of our engineers and the findings of our laboratories. *Service in Men* offers specialized consultation on individual tube application problems and suggestions regarding alloy selection and tube installation practice. *Service in Metals* includes the development and production of a wide range of tube alloys under laboratory control, which verifies that Scovill alloys conform to specifications.

*A "Condenser Tube Booklet" is available. Scovill Manufacturing Co., 13 Mill Street, Waterbury 91, Conn. *Export Dept.,* 405 Lexington Ave., New York 17, N. Y.

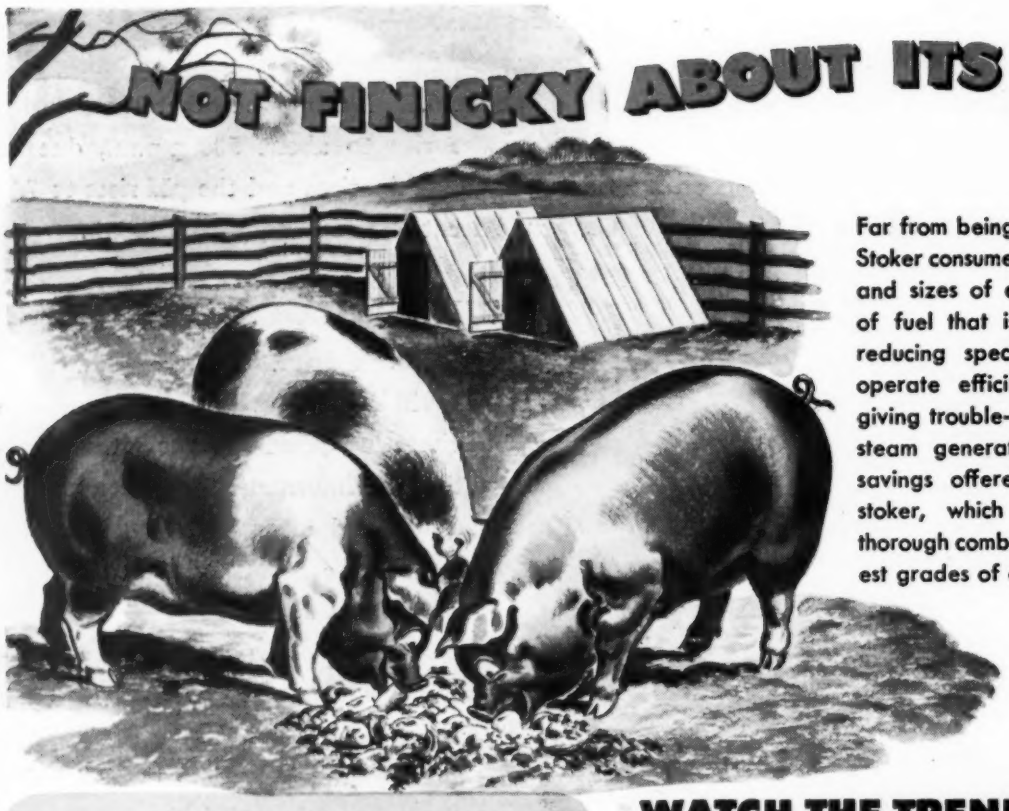
SCOVILL

SCOVILL CONDENSER TUBES

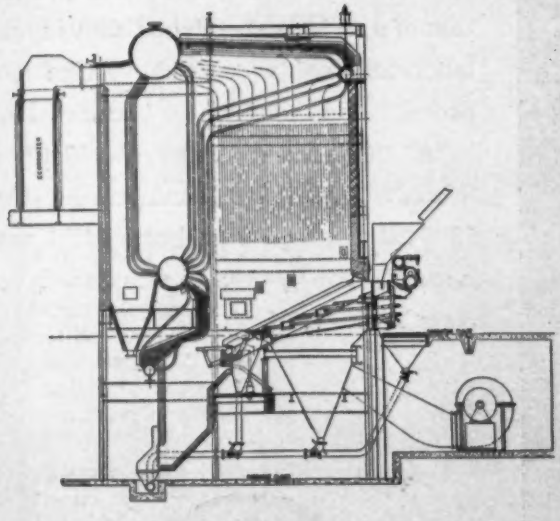
ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

NOT FINICKY ABOUT ITS FUEL!



Far from being "finicky," the Æ Taylor Stoker consumes a wide variety of types and sizes of coal. Feed it any grade of fuel that is suitable to your cost-reducing specifications, and watch it operate efficiently, economically . . . giving trouble-free service and low-cost steam generation. You'll welcome the savings offered by this fuel-flexible stoker, which assures you uniformly thorough combustion on even the cheapest grades of coal.



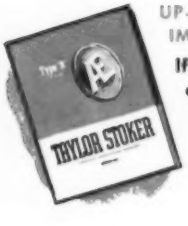
A typical recent installation of Taylor Stoker (Type 9 Retort 41RC9—Capacity 130,000 lb./hr.) in a large automobile manufacturing plant.

WATCH THE TREND!

Perhaps you already know of the preference for the Taylor Stoker—the stoker of *proved* performance. The Taylor Stoker has a record of highly efficient, reliable service in hundreds of boilers throughout the country.

Built upon engineering principles so sound that they have remained basically unchanged for over 35 years, the Taylor system of underfeed combustion has many modern improvements that make it *the* outstanding fuel-firing equipment for your power plant requirements. This stoker has simplified construction, continuous ash discharge and many other features that mean dependable. low-cost steam generation.

Don't take chances with untried, unproven stokers —specify Taylor and be safe. It's the leader!



UP-TO-DATE FACTS ON THIS IMPROVED TAYLOR STOKER

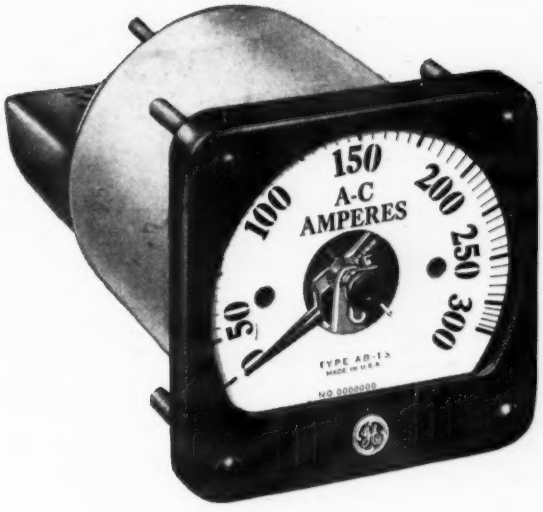
If you aren't up to the minute on Stokers, get your copy of this booklet. Write to Department 24 today!

TAYLOR STOKER

Æ

AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.



CONCENTRIC-SCALE instruments *Serve you better*

FOR ALL APPLICATIONS WHERE HIGH-QUALITY SWITCHBOARD INSTRUMENTS ARE NEEDED

Packed full of high-performance qualities, G-E concentric-scale switchboard instruments are engineered for modern requirements.

The long ***7-inch scale*** is easy to read accurately from any reasonable distance; and yet a large number of these instruments can be grouped in a small panel space to save reading time because of their small ***4¼-inch size***. ***Sturdiness*** never before achieved is built into the standard line for better long-time accuracy and lower maintenance cost.

The ***1-per-cent accuracy*** rating has added significance: it is easy to read "this close" on the long scale—visible under almost any arrangement of external illumination because of the ***antiglare*** cover glass. In fact, the ***anti-parallax*** scale and pointer help assure maximum accuracy even if readings are taken from an angle.

The over-all ***pleasing appearance*** of all the instruments will enhance the beauty of any equipment; with the added advantage of being ***easy to install***, since all required panel cutouts are circular.

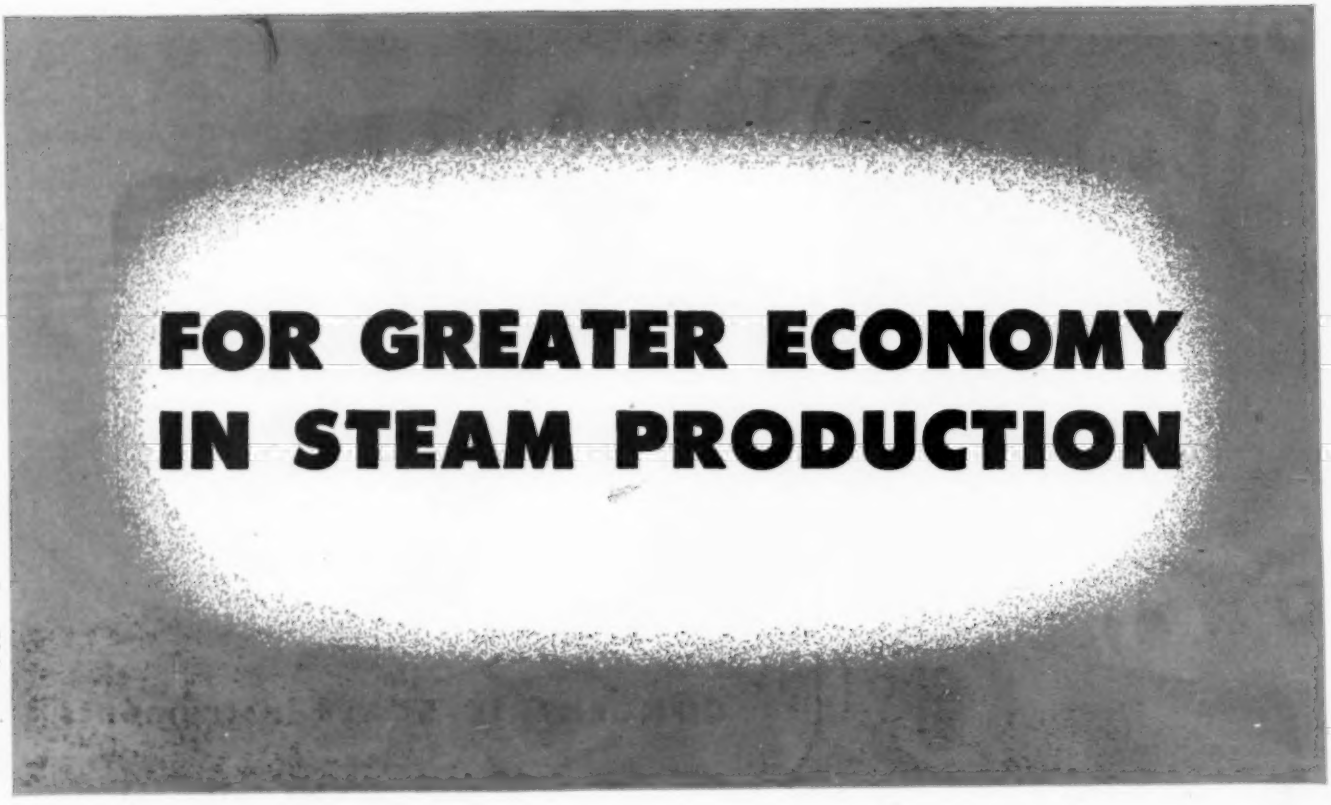
When these factors are combined with fast response, good magnetic damping, and requisite overload characteristics, the result is an instrument that will help do the job better, quicker, and more efficiently.

Call for concentric-scale switchboard instruments in your specifications. Bulletin GEA-3432 contains full details. Your copy is no farther away than the nearest G-E sales office. ***Apparatus Dept., General Electric Company, Schenectady 5, N. Y.***

HEADQUARTERS FOR MEASUREMENTS

GENERAL ELECTRIC

602-101-6290



. . . more and more of the country's large Power Users and Utility Plants each year, are turning to the DETROIT ROTOGRATE STOKER.

Proof of ROTOGRATE dependability and efficiency lies in the complete satisfaction and in the repeat orders of many long-time Users.

The ROTOGRATE successfully burns a wide range of fuels without special preliminary processing of the coal.

The ROTOGRATE quickly responds to widely fluctuating loads, maintaining high efficiency.

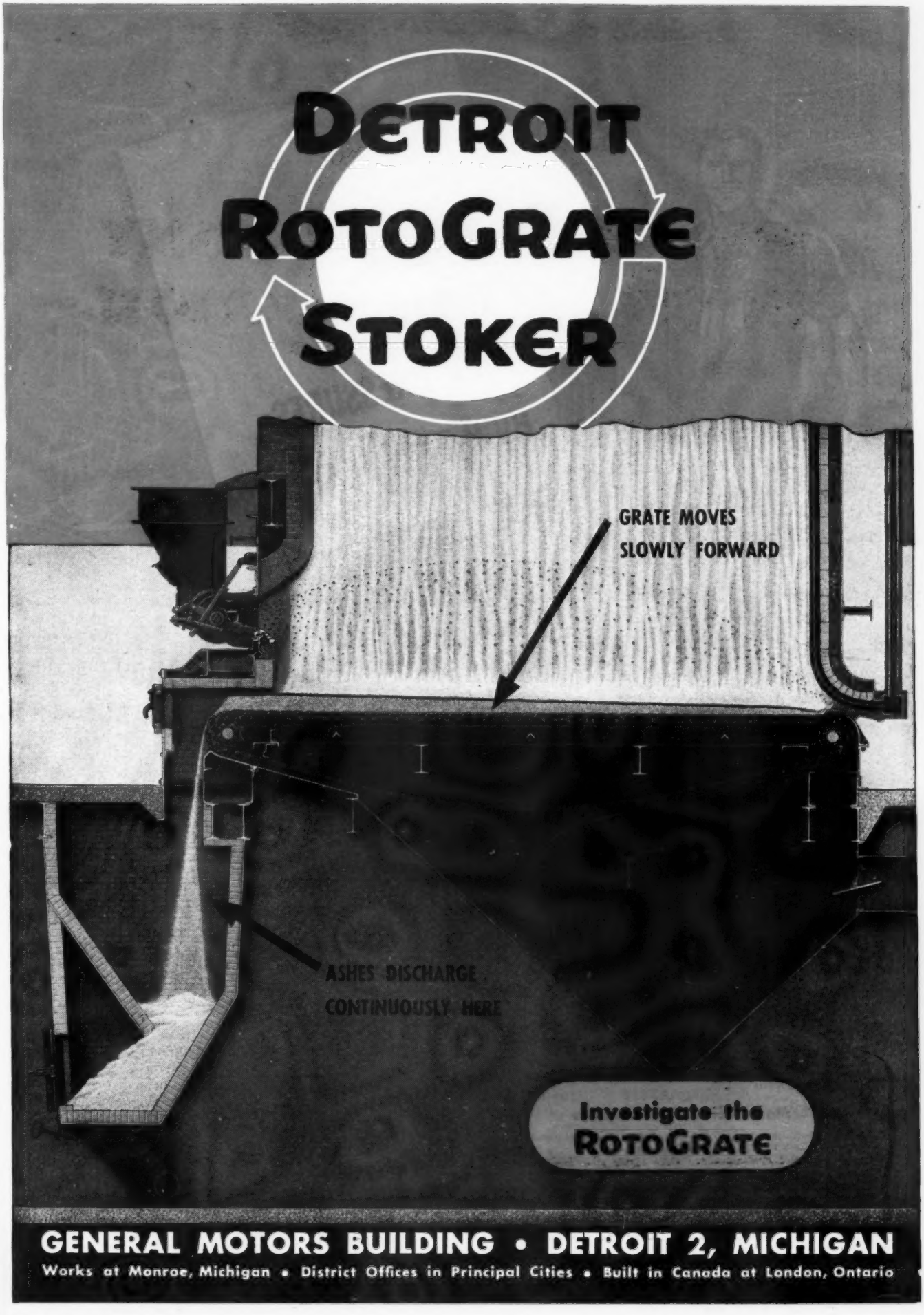
Ash is unusually low in carbon and clinkers are negligible.

Maintenance and power costs are unusually low.

INVESTIGATE THE ROTOGRATE in the interest of economy and better performance.

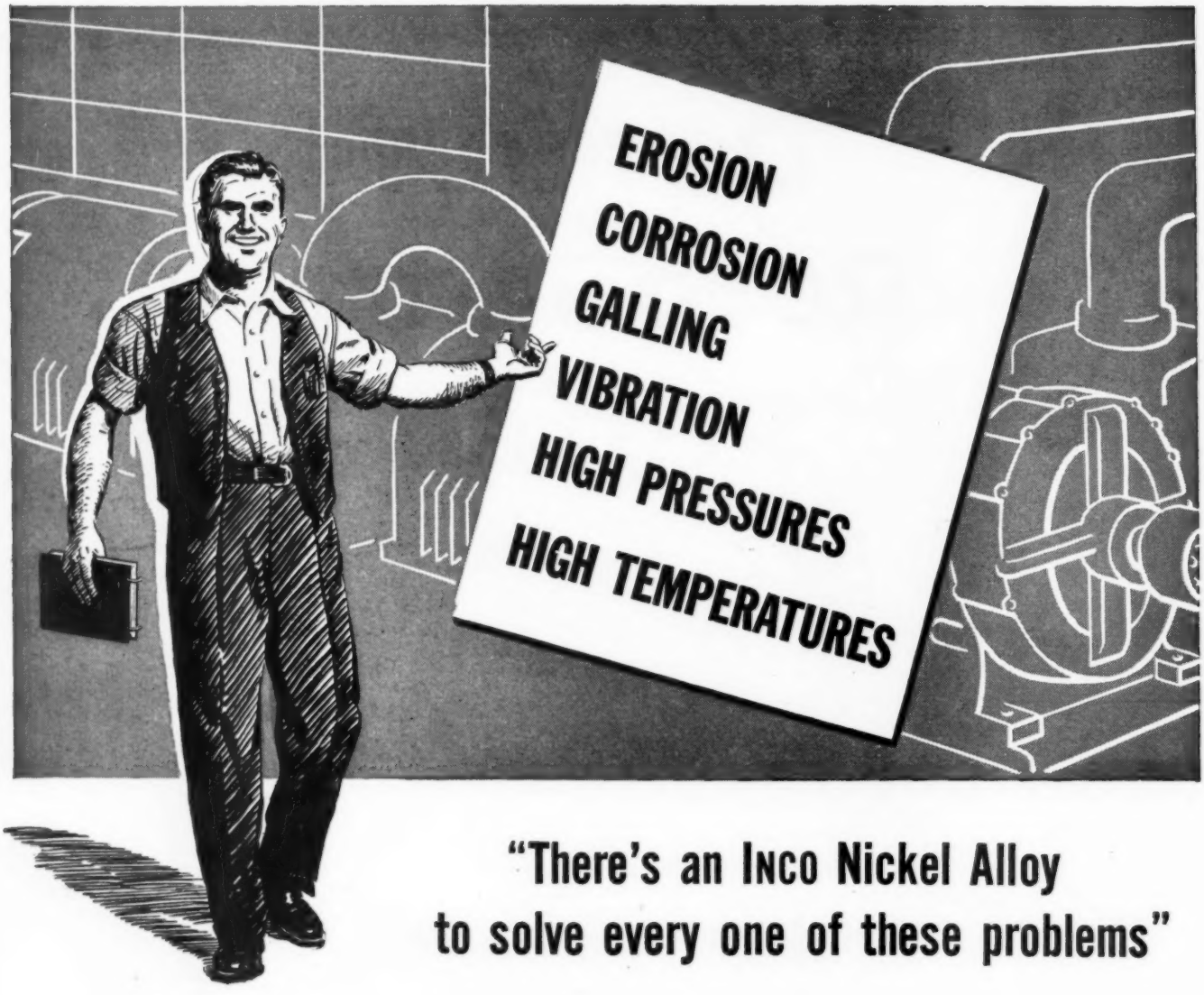
Our engineers will gladly explain its many advantages, without obligation.

DETROIT STOKER COMPANY



GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

Works at Monroe, Michigan • District Offices in Principal Cities • Built in Canada at London, Ontario



"There's an INCO Nickel Alloy to solve every one of these problems"

You're probably meeting these problems every day. They cause shut-downs, expensive repairs, and extra labor.

To beat them, engineers choose metals that can really "take it"... INCO Nickel Alloys.

These metals help fight the erosion of blasting steam and solid particles. They never rust. They resist corrosion caused by all natural elements and most chemicals. They help solve problems involving high temperatures, impact, and overstressing.

In valves, INCO Nickel Alloys prevent binding and galling. Nuts and screws made of these alloys stay tight ... but never freeze. Gaskets keep joints tight for years longer ... cut replacement costs 'way down.

In fact, wherever you use INCO Nickel Alloys you always build in extra performance. Listed below are the INCO Nickel Alloys now available to help step up the efficiency of your plant.

Make Allies *of these* Alloys

MONEL*—Rustproof, corrosion-resisting alloy for general applications that require a tough, high-strength material.

"R"* MONEL—Free-machining nickel-copper alloy for automatic machining and intricate machined shapes.

"K"* MONEL—Can be heat-treated after finishing—for applications that require a corrosion-resisting material with extremely high strength and hardness. Non-magnetic.

"KR"* MONEL—Machining-quality material which can be heat-treated to develop high mechanical properties similar to those of "K" Monel. Non-magnetic.

"S"* MONEL—Extremely hard and strong cast alloy for valve trim, pump liners, and similar applications. Non-galling. Retains high hardness at red heat.

INCONEL*—Heat-resisting nickel-chromium alloy to endure temperatures up to 2000°F. High hot-strength and resistance to progressive oxidation and inter-crystalline attack. Non-magnetic.

NICKEL—Commercially pure nickel for turbine blading, radio tube parts and electrical uses, gaskets, high temperature applications and corrosion-resisting service.

"D"* NICKEL—For spark plug electrodes, gas engine ignition tubes, thermometer wells and other high temperature applications not requiring a material with mechanical properties quite so high as those of Inconel.

"L"* NICKEL—Low-carbon nickel for special high temperature service (800-1100°F.), and for resistance to the corrosive effects of certain chemicals.

"Z"* NICKEL—Spring-quality material. Can be heat-treated after forming to develop 240,000 psi.

*Reg. U. S. Pat. Off.

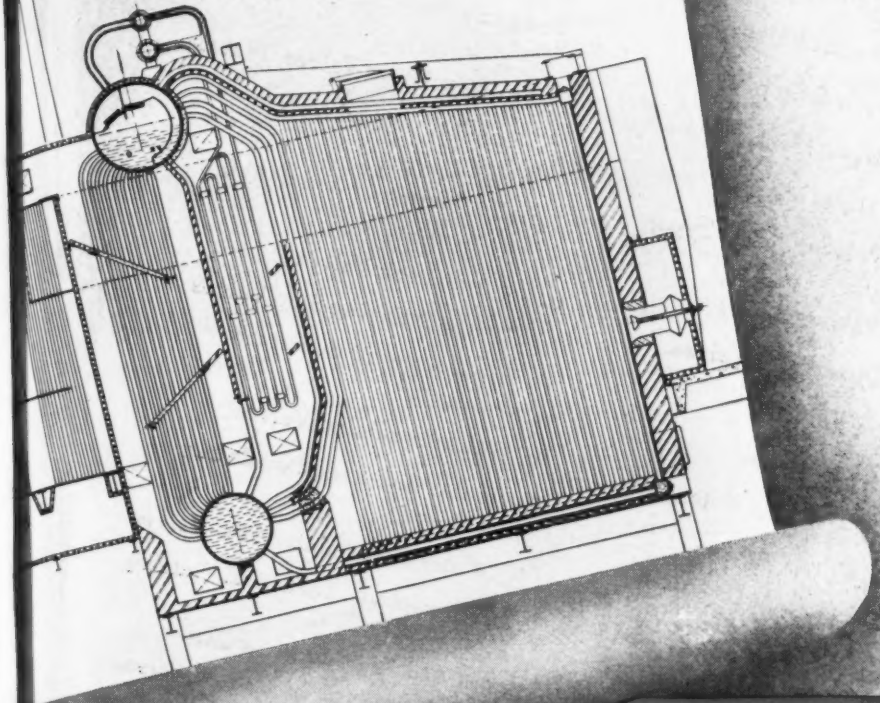
• • •

Detailed literature concerning the behavior and engineering properties of any of the above Nickel Alloys mailed on request.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

NICKEL INCO TRADE MARK **ALLOYS**

Look to SPRINGFIELD for the BEST in Modern Steam Generating Units



As rapidly as manufacturing facilities permit, Springfield Boiler Co. is bringing to users of steam generating equipment all that is improved and advanced in boiler design and construction. Even in designs little changed in general appearance, these improvements are noticeable in increased reliability... efficiency of operation... ease of maintenance. In other cases, purchasers of Springfield steam generators are now getting delivery on new and specially designed units built to meet individual requirements. If you are planning for the future now, LOOK TO SPRINGFIELD FOR THE BEST!

SPRINGFIELD BOILER CO.
1953 East Capitol Ave., Springfield, Illinois

Two Drum, Bent Tube, Springfield Design

- **RADIANT HEAT FURNACE.** Water cooled surface disposed to meet each particular operating condition. Minimum furnace maintenance required.
- **DRY STEAM.** Multiple stage steam separators effectively prevent possibility of carry-over and insure dry steam at all operating rates.
- **SUPERHEATER.** Interbank type, designed to give minimum variation in steam temperature over wide range. Easily serviced, readily accessible.
- **DRUMS.** Welded, X-rayed and stress-relieved to meet all specified code requirements.
- **AIR PREHEATER.** Clean cut, easy to maintain and simple in arrangement.
- **SYMMETRICAL DESIGN.** Note that the Springfield design is compact and symmetrical. Gases enter the tube bank across the entire width of the unit. This full width flow is maintained through the tube banks, superheater, air heater and economizer, if one is used. Temperature of gases at any particular section is practically uniform across the entire width.
- **SIZES.** Offered in capacities from 20,000 lbs. up and for pressures up to 900 p. s. i.
- **FIRING.** Firing may be by coal, oil or gas.

SEE OUR CATALOG IN SWEET'S

SPRINGFIELD BOILERS

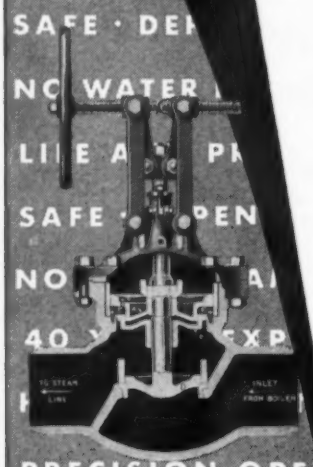
SAFE · DEPENDABLE · PRECISION OPERATION · 40 YEARS EXPERIENCE
NO WATER HAMMER · AUTOMATIC · MANUAL · HYDRAULIC · UNIFORM
LIFE AND PROPERTY · ECONOMICAL · LONG LASTING · DEPENDABLE

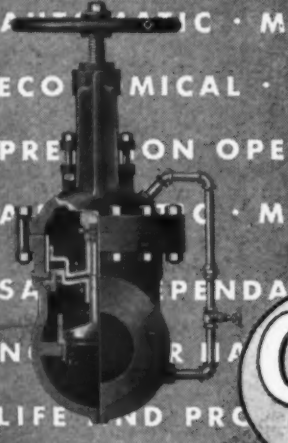
GOLDEN-ANDERSON
Headquarters

FOR SAFE, DEPENDABLE CONTROL VALVES
USED IN STEAM AND HOT WATER SERVICE

- ☐ Air Reducing-Regulating Valves
- ☐ Altitude Control Valves
- ☐ Boiler Check & Stop Valves
- ☐ Check Valves, Electric Type
- ☐ Check Valves, Manual Type
- ☐ Check Valves, Piston Type, Automatic
- ☐ Check Valves, Swing
- ☐ Coke Quenching Valves
- ☐ Deluge Valves
- ☐ Descaling Valves
- ☐ Emergency Trip Valves
- ☐ Engine Stop Valves
- ☐ Float Valves
- ☐ Plain Non-Return Valves
- ☐ Reducing-Regulating Valves, Air and Steam
- ☐ Reducing-Regulating Valves, Water
- ☐ Relief-Regulating Valves, Water
- ☐ Solenoid Operated Valves, Water
- ☐ Steam Reducing-Regulating Valves
- ☐ Swing Check Valves
- ☐ Throttle & Engine Stop Valves
- ☐ Triple Acting Non-Return Valves
- ☐ Unloading-Relief Valves
- ☐ Water Reducing-Regulating Valves
- ☐ Water Relief-Unloading Valves
- ☐ Descriptive, Technical Catalog

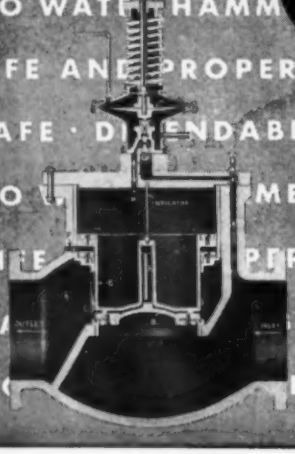
Check the Type of Valves you need and mail to Golden-Anderson for complete information.

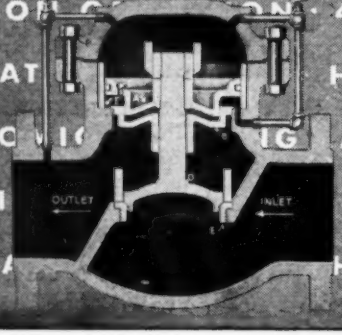


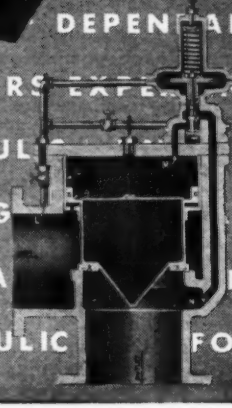


GA

GOLDEN-ANDERSON
***VALVE* Specialty Company**
KEENAN BUILDING · PITTSBURGH 22, PA.







LET IT RAIN! LET IT SNOW!

It's a fact! Feed the Æ Perfect Spread Stoker any grade of coal and watch it operate perfectly—without clogging, whether your coal supply is wet, dry, or partially frozen. This and many other operating features are exclusive with Perfect Spread and are not available in any other stoker.

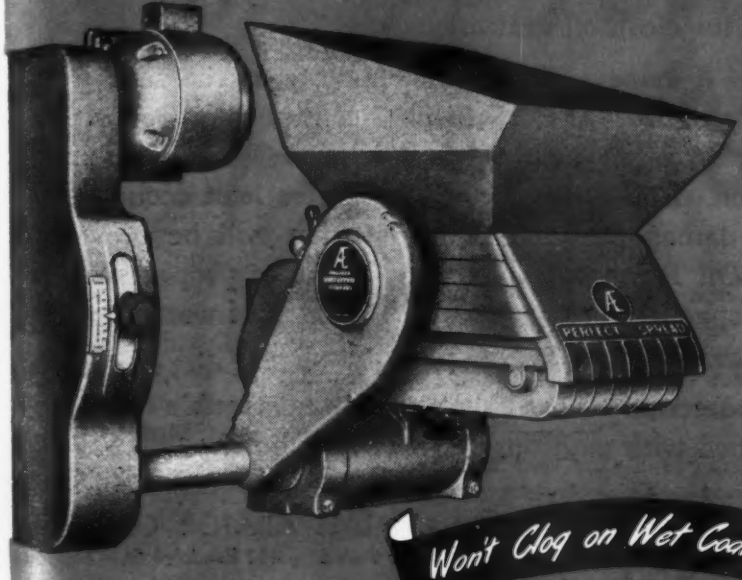
But "the proof of the pudding is in the eating." With scores of Perfect Spread Stokers in operation and production going full speed to satisfy the large number of orders promptly, it is evident that the Æ Perfect Spread Stoker is accepted as a highly efficient and economical stoker. Before buying any fuel firing equipment, investigate! Write for descriptive booklet today!

WET COAL WON'T CLOG

PERFECT SPREAD STOKER

WITH TRAVELING, DUMPING OR STATIONARY GRATES

THIS STOKER



Won't Clog on Wet Coal!

The Perfect Spread Stoker has a record of proved economy and cost-cutting efficiency in many industries—over an 18-year period.

Æ

FREE—Get this valuable descriptive booklet on the Æ Perfect Spread Stoker today!

Address inquiries to 2400 Aramingo Ave., Philadelphia 25, Pa.

Other Æ Products: Æ-TAYLOR STOKERS, LO-HED HOISTS MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

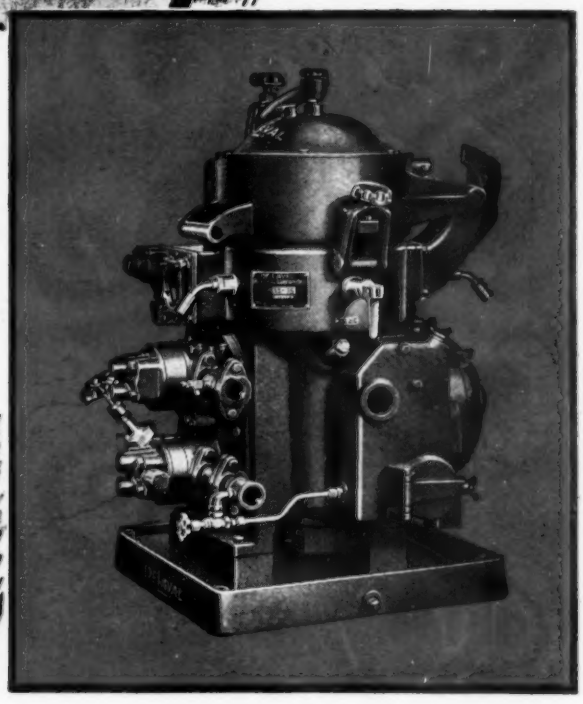
AMERICAN ENGINEERING COMPANY

2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.

MEMO

When you spend money for a Turbine Oil Purifier - Get a Centrifugal Machine-

IT REMOVES WATER AS WELL AS DIRT!



Consider the advantages of providing your power unit with a De Laval Oil Purifier. The Purifier is a machine wholly mechanical in action. It requires no periodic replacement of functional parts to maintain its working efficiency. It separates out dirt from the oil instantaneously and discharges the clean oil continuously.

And It Removes Water Continuously at the same time. This is of great importance in the purification of turbine oils, for water in turbine oil is a prime source of sludge formation. And should a sudden water leak occur, really serious damage through emulsification will be prevented by the Oil Purifier. A De Laval unit of proper size has ample capacity to remove sudden "slugs" of water.

That is complete protection—removal of dirt ***and*** water. Since protection costs a fraction of what trouble does, why be satisfied with anything less than the best?

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

LUBRICATING OIL PURIFIERS

Sheave to Transmit 1400 Horsepower...

...or a Belt for a 1/4 hp Compressor!

CALL ON THE TEXROPE LINE for the *best* in V-belt engineering and V-belt equipment. That has been true for 22 years — ever since Allis-Chalmers originated the Multiple V-belt drive for industry.

Back of every *Texrope* installation — from fractional horse power V-belts that manufacturers put on washers, air-compressors or water systems—to the biggest V-belt drives ever designed and successfully applied—stands the finest V-belt engineering talent in the world.

There's no substitute for this vast experience and tremendous fund of knowledge. It is reflected in every *Texrope* product.

What do *you* need... a few V-belts and sheaves — or a daring new application of the multiple V-belt principle? Call on the *Texrope* line! Equipment and engineering help are as close as your nearest A-C sales office or dealer. ALLIS-CHALMERS, MILWAUKEE.

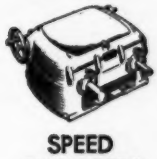
A 2187

TEXROPE ..Greatest Name in V-Belt Drives

"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationery or motion control.



SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

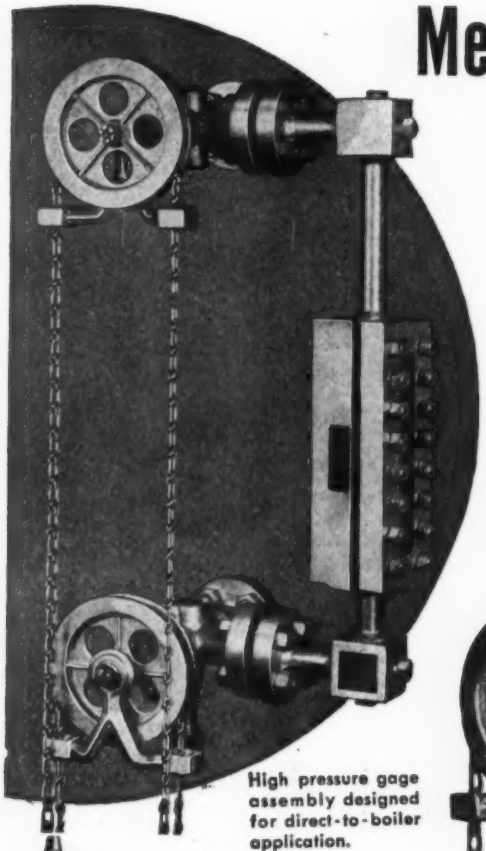
ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

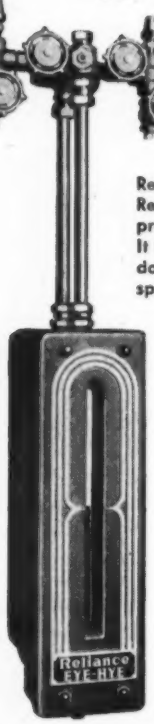
1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great

Meet HIGH PRESSURES with Reliance Equipment

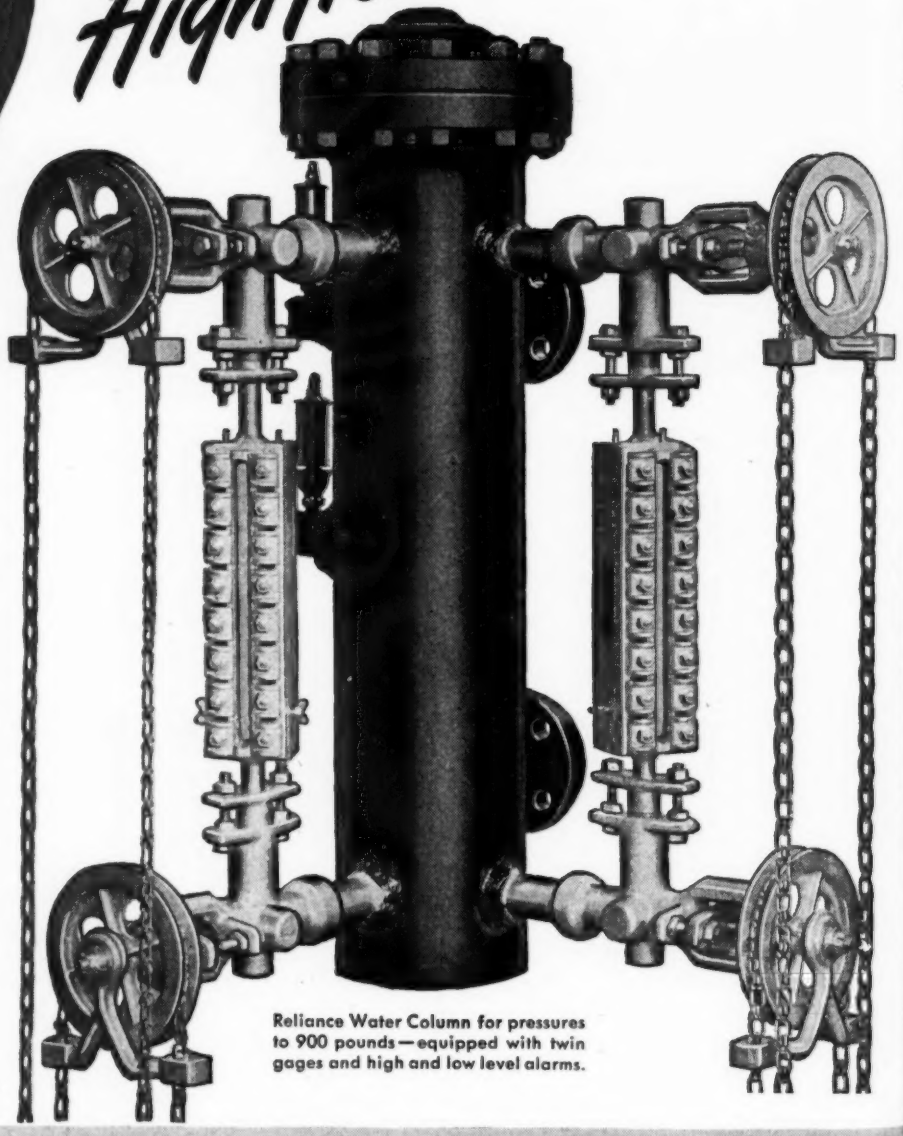
built for High Pressure Safety



High pressure gage assembly designed for direct-to-boiler application.



Reliance EYE-HYE Remote Reading Gage is built for pressures to 2000 pounds. It brings accurate reading down to eye level or any special desired position.



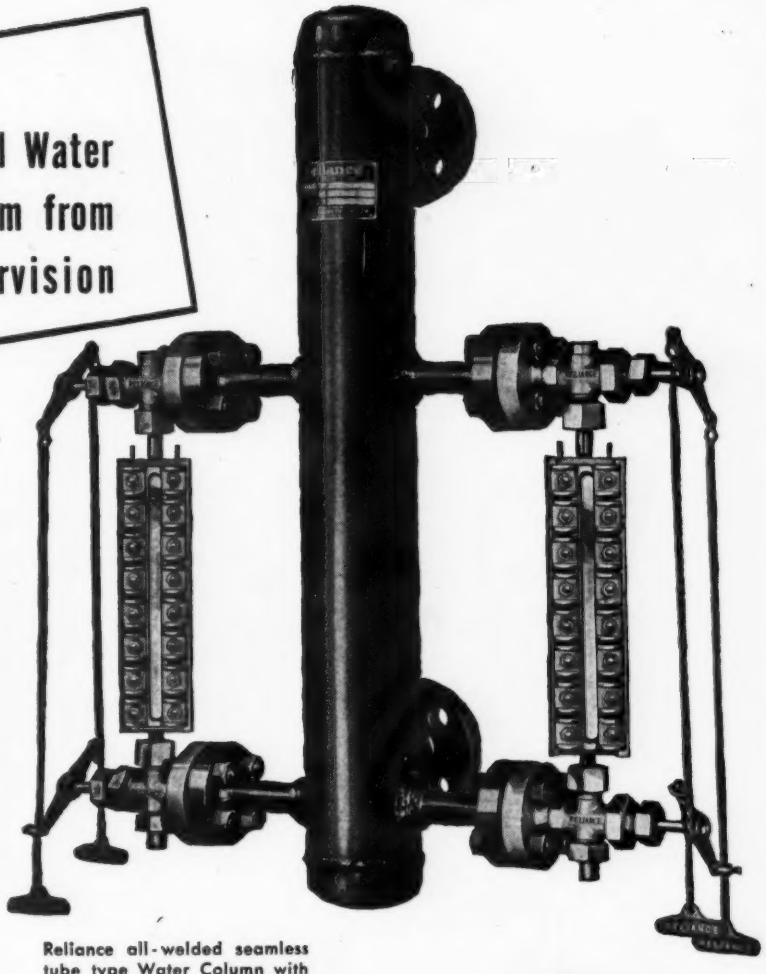
Reliance Water Column for pressures to 900 pounds—equipped with twin gages and high and low level alarms.

Since 1884

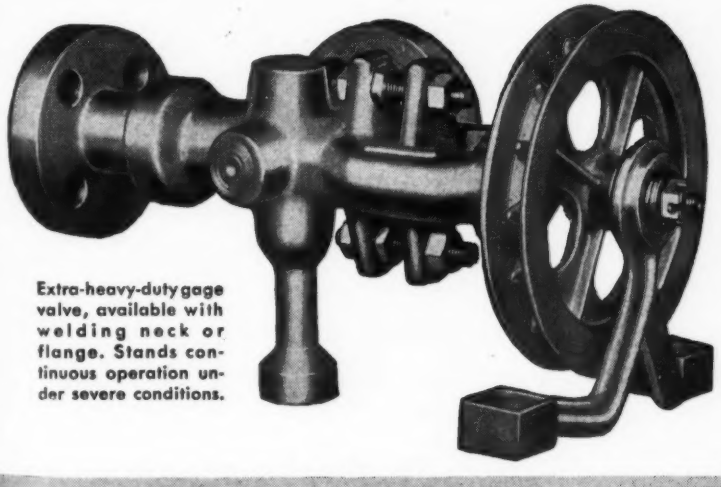
Reliance

. . . Rugged Water Columns and Water Gages that assure you freedom from failure of Water Level Supervision

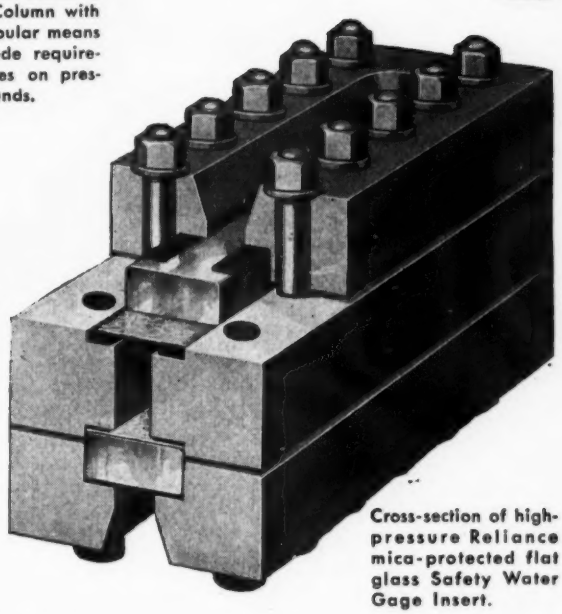
● You don't "fool around" with high pressures. Their basic economy and versatility serve you well in today's efficient engineering practices, but you like to have an extra margin of safety in the equipment designed for high pressure plants. You find Reliance ready to supply Boiler Water Columns and Gage Equipment having the necessary ruggedness, safety features, and extra capacity well above their ratings; also special engineering when needed for the individual installation. Sixty-three years of specialization spell *authority* on this type of equipment. Reliance builds the bulk of water columns and safety boiler gages used in America—is the only manufacturer whose facilities are devoted entirely to this type of equipment.



Reliance all-welded seamless tube type Water Column with twin gages—a popular means of meeting the code requirement for two gages on pressures over 400 pounds.



Extra-heavy-duty gage valve, available with welding neck or flange. Stands continuous operation under severe conditions.



Cross-section of high-pressure Reliance mica-protected flat glass Safety Water Gage Insert.

BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
5902 Carnegie Ave., Cleveland 3, Ohio

NON-METALLIC DISC

The valve that

Non-heat handwheel. Operator's hand does not contact end of stem, which may be hot.
Gland with hexagon head for wrench hold.
Repackable under pressure. Repacking seat above stem thread.
Stem material is a new Lunkenheimer development providing exceptional resistance to stem-thread wear.
Screw-over bonnet provides great strength.
Disc holder slip-on type. Perfectly guided. Extremely close tolerances prevent "cocking."
Non-metallic disc easily renewed.

Fig. 123

QUICKLY RENEWABLE

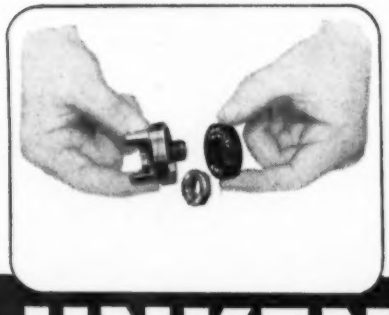
The initials "N. M. D." designate LUNKENHEIMER VALVES equipped with NON-METALLIC-DISCS. (One long-time user insists that the abbreviation means NONE MORE DEPENDABLE).

ELIMINATES RE-GRINDING

The N. M. D. Valve's unique design and construction provides for easy replacement of discs and the assurance of maximum tightness under all conditions. No regrinding necessary. In handling steam, hot or cold water, air, gas, gasoline, oil, and other fluids, N. M. D. Valves deliver uninterrupted service on a "lower cost per year" basis.

ASK YOUR DISTRIBUTOR for a DEMONSTRATION

He will show you how the N. M. D. can be renewed "P. D. Q." Phone him today.



LUNKENHEIMER VALVES

BRONZE, IRON, STEEL, AND CORROSION RESISTANT ALLOY VALVES
AIR DEVICES, LUBRICATORS, AIRCRAFT FITTINGS

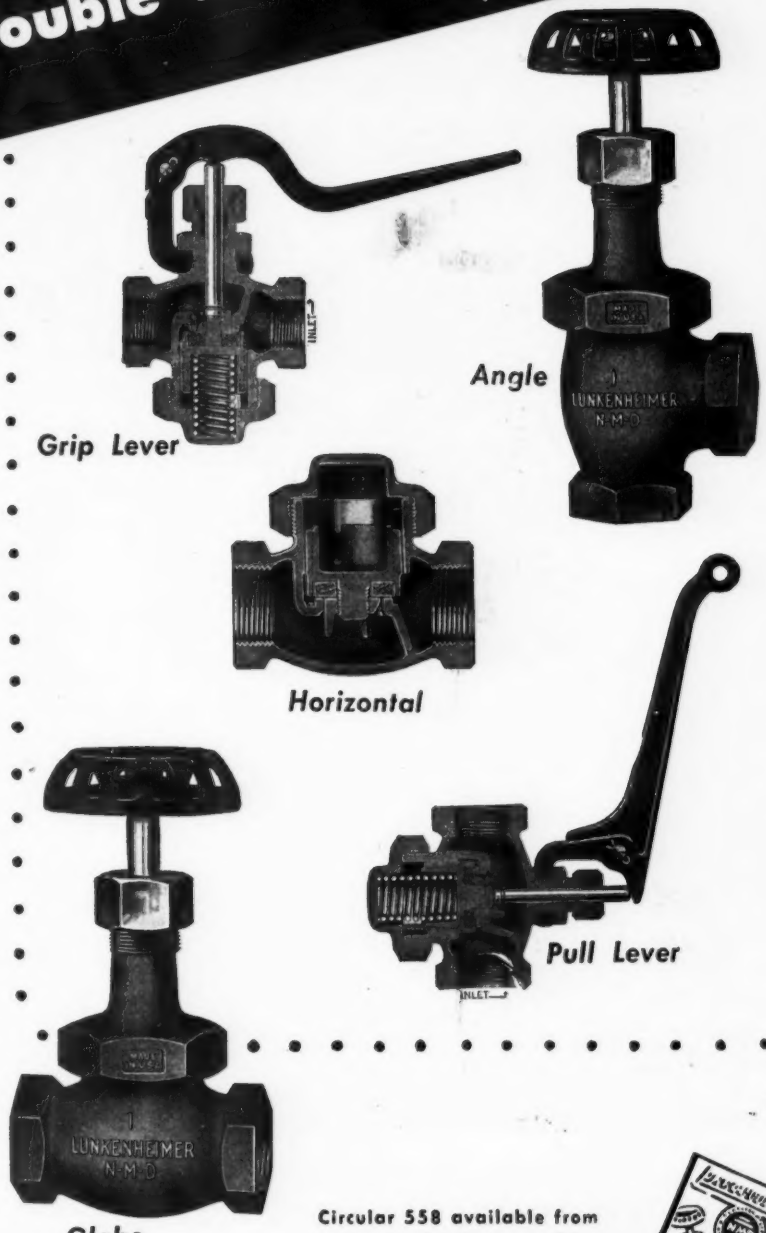
saves time, trouble and maintenance...

N. M. D. VALVES

In Globe, Angle Check and Quick Operating Types

Renewals quickly made. Unscrew locknut from disc holder; remove old disc and insert new one. Reassemble and valve is good as new. Save additional time by keeping on hand some spare disc holders, complete with discs—slip a disc holder and a new disc on the stem and remove the old disc from holder at your convenience.

N. M. D. Non-Metallic discs are made in four basic types: No. 20 for steam, hot water. No. 30 for cold water, gas, air. No. 50 for gasoline, oil, butane, propane. No. 10 for steam (free from scale).



Circular 558 available from your Lunkenheimer Distributor or write for copy.

THE LUNKENHEIMER CO., Cincinnati 14, Ohio, U. S. A.
New York 13, Chicago 6, Boston 10, Philadelphia 7
Export Dept.: 318-322 Hudson St., New York 13, N. Y.

Specify Republic

A Republic combustion control system operates the three boilers in this new power plant which supplies all the steam and power for a large university. During the first year of operation this new plant provided heat for 13[illegible] percent more building space, generated 114.3 percent more electric power but consumed 9.86 percent less fuel

REPUBLIC
INSTRUMENTS
AND CONTROLS

Combustion Control

TO INCREASE TODAY'S STEAM PRODUCTION

TO DECREASE TOMORROW'S STEAM COST

The installation of Republic automatic controls on your boiler (or boilers) will enable you to:—

SAVE FUEL by automatically maintaining highest combustion efficiency.

INCREASE STEAM OUTPUT by operating the boilers at test efficiency 24 hr. a day, 7 days a week.

CONSERVE MANPOWER by automatically performing the many routine repetitive adjustments.

REDUCE OUTAGES by maintaining uniform operating conditions and thereby prevent the chain-of-event type of trouble that frequently developes as a result of incorrect boiler operation.

An automatic combustion control system, as designed and built by Republic, will help you meet today's need for more steam and tomorrow's need for lower steam costs.

The Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler. It increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency. It not only checks operation but automatically makes necessary corrections of individual factors before faulty operation has a chance to develop.

The difference between such a control and an assembly of uncoordinated regulating devices is comparatively small in equipment but great in principle. Merely to provide automatic operation of a number of individual device is not enough.

CHECK THESE FEATURES

Built into the Republic combustion control systems are many features that enable it to fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of everyday operation.

Check the following features against your list of "musts" for a perfect combustion control system.

CENTRALIZED CONTROL: The operation and control of the boiler or boilers is centralized at the master controller.

FUEL-AIR RATIO INDICATOR: The master controller is provided with mercury manometers which indicate the measured fuel and air inputs to the boiler and the fuel-air ratio.

FUEL-AIR RATIO ADJUSTMENT: A handwheel on the front of the master control panel provides a convenient means for adjusting the fuel-air ratio.

ALL BOILER RATINGS: Maintains proper fuel-air ratio over the entire range of boiler ratings.

CONSTANT STEAM PRESSURE: Maintains the plant steam pressure within narrow limits of variation by proportioning the fuel and air inputs to the load.

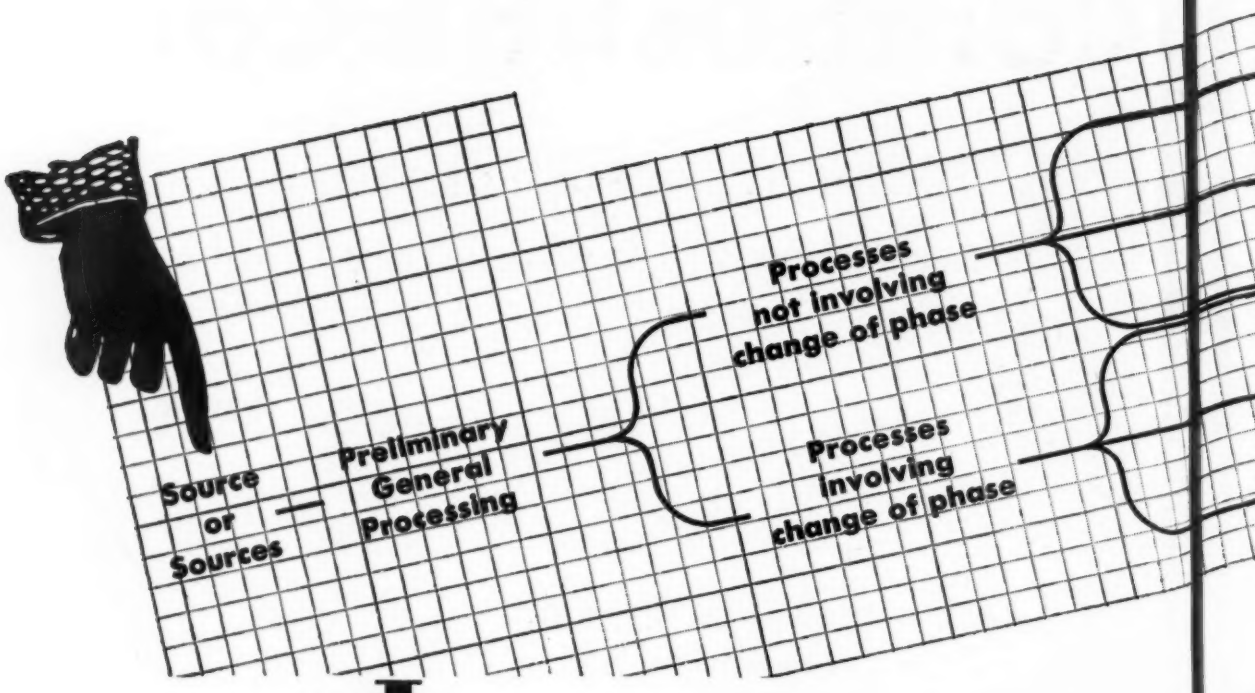
LOAD DISTRIBUTION: Provides a means of distributing the load among the boilers as desired.

MANUAL CONTROL: Boiler ratings can be controlled manually by a handwheel located on the front of the panel.

Find out about Republic control systems. One of our engineers will be glad to consult with you at any time. Write us today.

Republic Flow Meters Co.

2240 Diversey Parkway • Chicago 47, Illinois


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

Let's consider

Water is Problem Number One in plant planning.

Procedures and equipment throughout the plant may be influenced by the nature and extent of the available water supplies, and by the characteristics of the water. Nor is this influence in one direction only. Problems are so interwoven that orderly progression of solutions is seldom possible. Each problem must be solved in relation to all the others. Water sources may be factors in determining methods of water re-use and disposal—but these in turn will be factors in the selection and utilization of water sources. The very location of the plant may hinge on the water available.

TYPES OF SOURCES

Water sources are varied, but those usually open to industrial plants fall into three major classes: wells; streams and—in some areas—lakes; and municipal water systems. Some problems are common to all three sources, but in addition each has its own specific problems.

WELLS

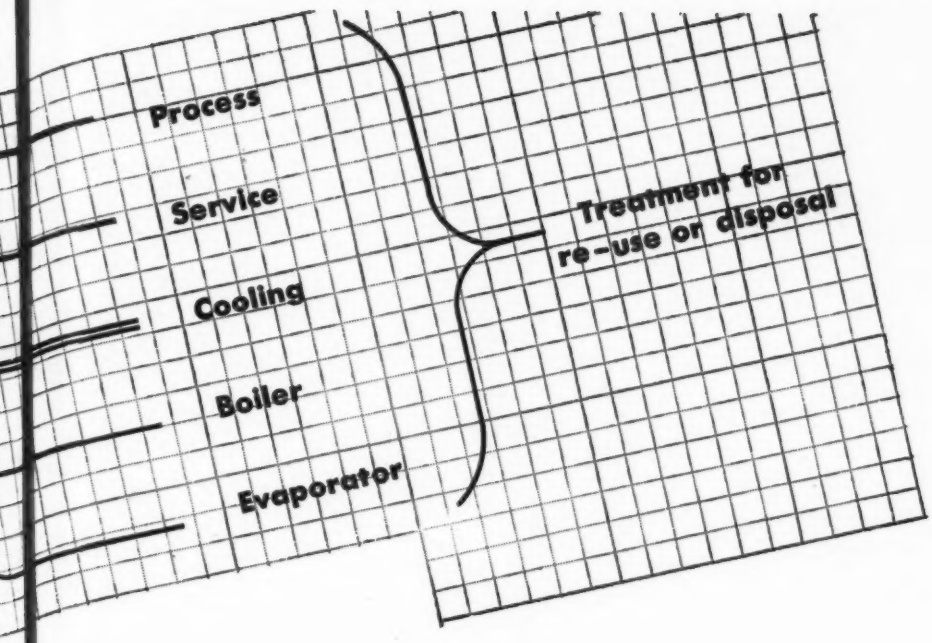
Wells, for example, require a thorough knowledge of the underlying water table. Water levels vary from year to year and from season to season. Is there danger that it will fall too low to meet plant needs? What changes in water characteristics, such as mineral content, suspended solids, bacteria count, etc., are likely to accompany changes in water level? When water level falls below a certain point, salt water may force its way in. Is this likely to happen in your situation?

Will the water demand of your plant lower the water level? Is it likely to be affected by population growth in the area, or by new industrial construction?

STREAMS AND LAKES

Characteristics of lake water are usually fairly constant, but streams may in many cases be even more variable than wells. Flow varies with rainfall, and may be affected by conditions hundreds of miles from the plant.

HAGAN
HALL
BUROMIN
CALGON



WATER SOURCES

Certain seasons may bring a huge increase in suspended or dissolved solids, or a higher percentage of organic matter. Hardness may vary; a range from 2 to 9 grains during the year is not uncommon. Contamination from other plants—or from your own plant—may have to be reckoned with. Even the temperature of the water may be an important factor.

MUNICIPAL SYSTEMS

Water from municipal systems, having been treated to make it suitable for domestic use, will be suitable for plant service water—but is treatment to reduce scale and corrosion advisable? Will it meet your requirements for process water? How does its cost balance against possible saving in investment? Is it a dependable source of supply or will you be expected to curtail consumption during dry periods?

When more than one source is available, what can be expected from each? Which source or combination of sources should be used? How can each be employed to best advantage?

THE FUNCTION OF HALL LABORATORIES

These are only a few of the problems that arise in considering water sources. All such problems, and every other problem concerning the use of water in industry, come within the scope of Hall Laboratories.

Hall Laboratories not only understands these problems, but *knows their implications in plant construction and operation*—knows that the answer must ultimately be in terms of dollars and cents. Hall Laboratories is prepared to recommend procedures which, taking all factors into account, represent the most economic and efficient solution *in your specific situation.*

Correspondence on any industrial water problem is invited.

HALL LABORATORIES, INC. • HAGAN BUILDING, PITTSBURGH 30, PA.

HALL LABORATORIES, INC.

(A Subsidiary of Hagan Corporation)

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

and of course

Your Plans Include

MARLEY

COOLING TOWERS

AND

COOLING EQUIPMENT

The Marley Company builds such a complete line of cooling towers and equipment that a Marley unit will accurately, economically fit every proposed air-conditioning, refrigeration or processing project now in planning stage. Your surest guarantee of excellent performance upon completion, is the quarter century record of Marley towers in service the world over.

Every Marley tower is the product of constant pioneering and development in thermal engineering; each the dominant design in its field.

MARLEY TOWERS and EQUIPMENT in your plans assure perfection in your project.

One-Piece Nozzle—For cooling towers, spray ponds and large capacity installations.

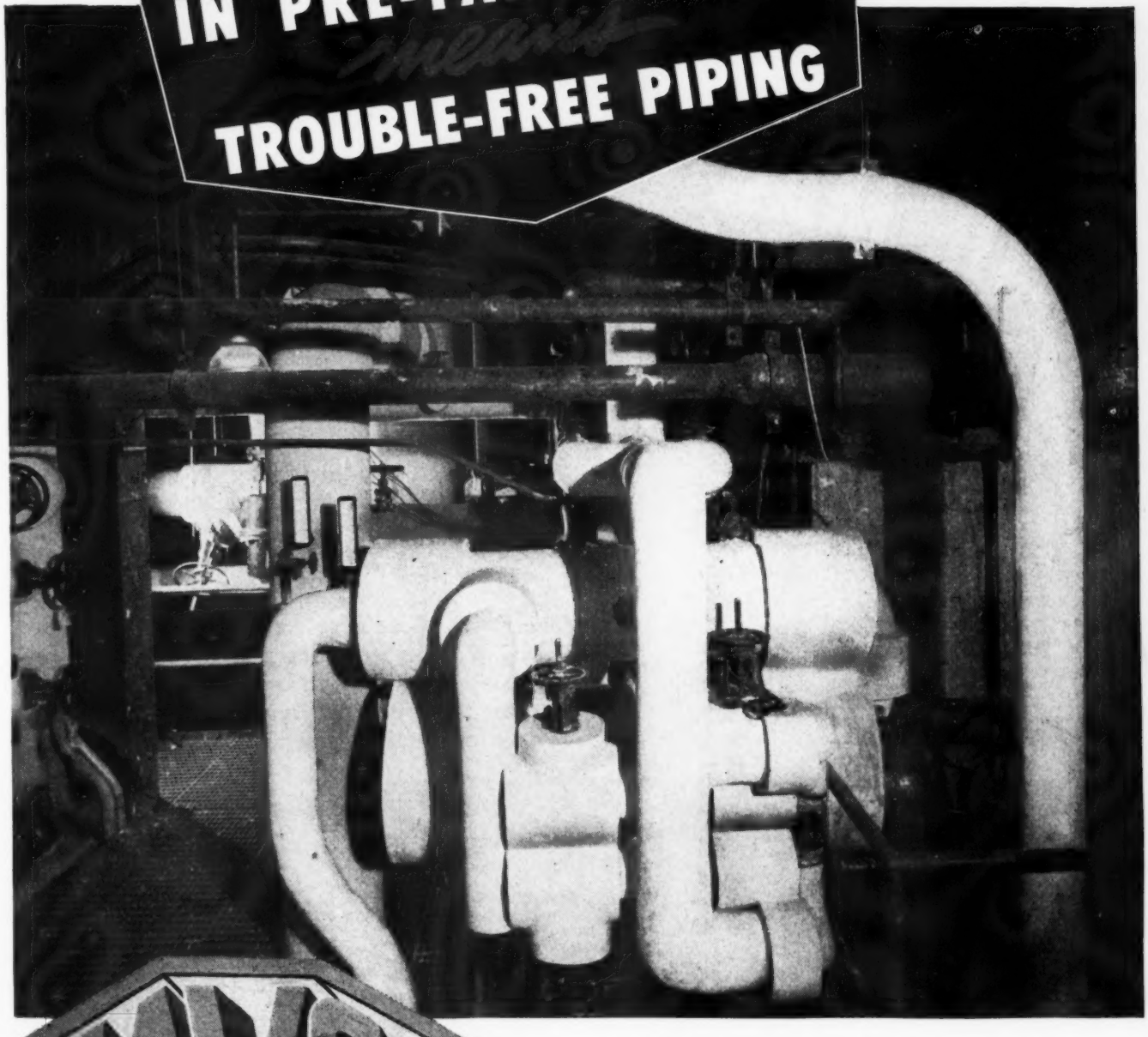
Two-Piece Nozzle—For all spraying and cooling equipment. Readily cleaned.

Atomizing Nozzle—For humidifying, vaporizing; where a "mist-like" spray is required.

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

NAVCO ACCURACY IN PRE-FABRICATION ensures TROUBLE-FREE PIPING



NAVCO

Prefabrication accuracy is an essential "MUST" to assure a proper fit and economical operation. Navaco's 40 years' experience in fabricating assemblies in all sizes and for all operating conditions is your assurance of such accuracy.

Consult Navco for your next piping job.

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

More than a Century ... and valves only

OF MAKING VALVES

More than 100 years ago the Wm. Powell Company dedicated itself to the making of valves—*and valves only*. Thus Powell pioneered in the field of specialization long before the "age of specialization" arrived.

The soundness of this policy, backed by continual scientific advancement and the ability to meet every new demand as it has arisen, is attested by the high quality of Powell Valves today.

The Powell Line is so complete that there's a Powell Valve—*in Bronze, Iron, Steel, Pure Metals* or *Special Alloys*—to satisfy every known flow control requirement in every branch of modern industry.

Fig. 375 — 200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet, and renewable, wear-resisting "Powellium" nickel-bronze disc.

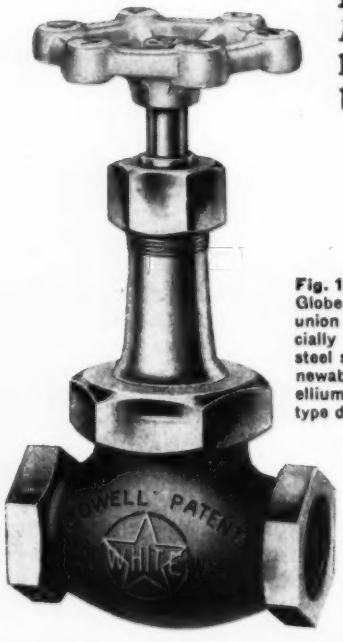


Fig. 1708—200-pound Bronze Globe Valve. Has screwed ends, union bonnet, renewable, specially heat-treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze, plug type disc.,

Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve. Flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc. Disc, when wide open, permits full, unobstructed flow through the valve body. Also available in All Iron.

POWELL

Fig. 301—125-pound Iron Body Bronze Mounted Globe Valve. Has flanged ends, outside screw stem, bolted flanged yoke, renewable bronze seat and renewable composition disc.

Fig. 1793 — 125-pound Iron Body Bronze Mounted Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke, bronze seat rings and taper wedge solid disc. Also available in All Iron.

Fig. 560—200-pound Bronze Regrinding Horizontal Swing Check Valve. Screwed ends, screwed-on cap and regrindable, renewable bronze disc.

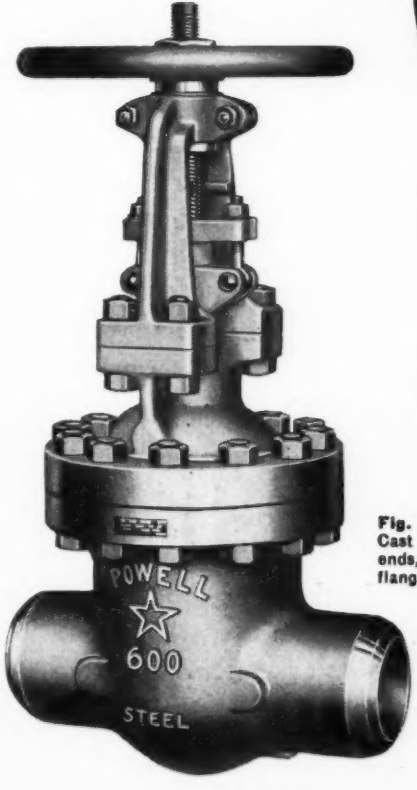


Fig. 6003 W. E. — Class 600-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc.

Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.

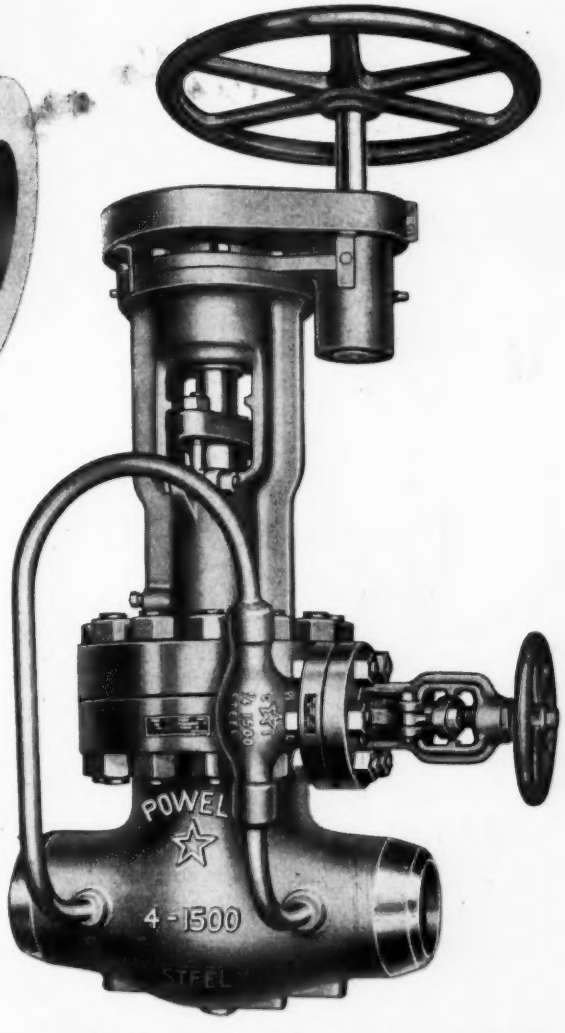


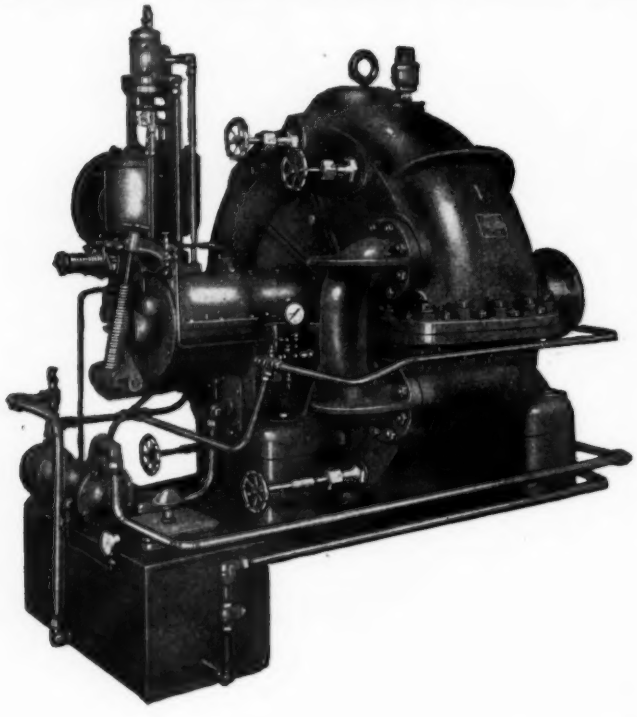
Fig. 1331 W. E.—Class 1500-pound Cast Steel Globe Valve with welding ends and welded by-pass. Spur gear operated.

The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

TERRY



THE WHEEL OF THIS 165 lb. BACK PRESSURE TURBINE IS DOUBLE RIM PROTECTED

The 925 H. P. Back Pressure Turbine shown above employs a Terry Solid Wheel Rotor as shown at the left.

The buckets are protected by rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the clearance became reduced.

With this construction it is impossible for the blades to foul and frequent inspections of the thrust bearings are not required to obtain safe and dependable operation.

The Terry Wheel Turbine is fully described in our Bulletin S-116. A request on your business letterhead will bring a copy.

T-1165

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

MILE LONG

HIGH PRESSURE — HIGH TEMPERATURE

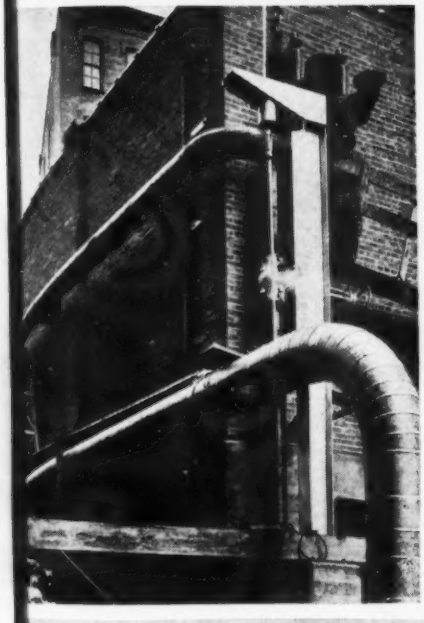
STEAM LINE INSTALLED

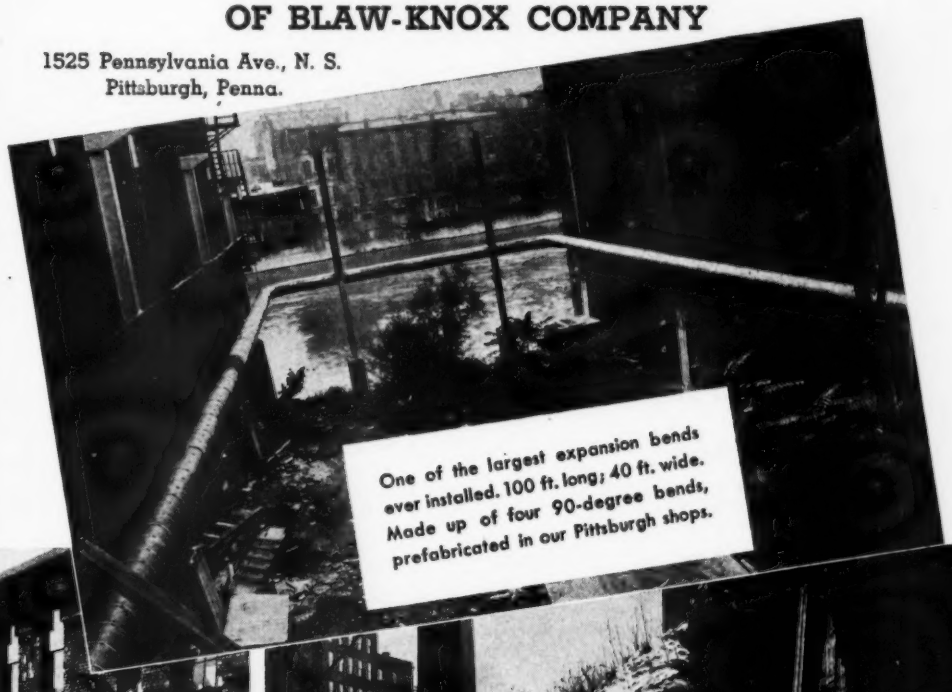
This ten-inch line carries steam at 650# pressure and 750 degrees Fahrenheit for nearly a mile over rough terrain and through the heart of a prominent American city. Blaw-Knox engineers prepared basic calculations and design. The increments of this line were all prefabricated in Blaw-Knox shops. Installation was made by experienced Blaw-Knox piping erectors. The line is carried by Blaw-Knox Functional Hangers and Vibration Eliminators.

Blaw-Knox Power Piping Division offers a superior combination of experience, facilities and ability to buyers of heavy power piping installations.

POWER PIPING DIVISION
OF BLAW-KNOX COMPANY

1525 Pennsylvania Ave., N. S.
Pittsburgh, Penna.



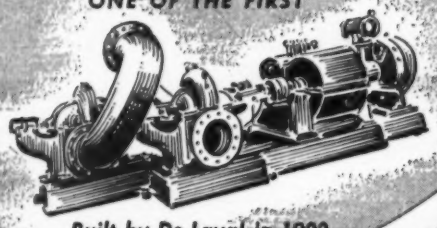


One of the largest expansion bends ever installed. 100 ft. long; 40 ft. wide. Made up of four 90-degree bends, prefabricated in our Pittsburgh shops.

POWER PIPING DIVISION OF BLAW-KNOX COMPANY

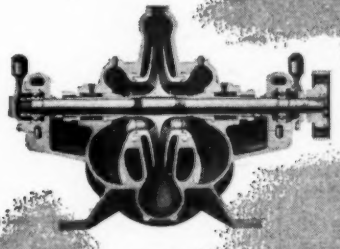
45 Years of PUMP IMPROVEMENT

ONE OF THE FIRST

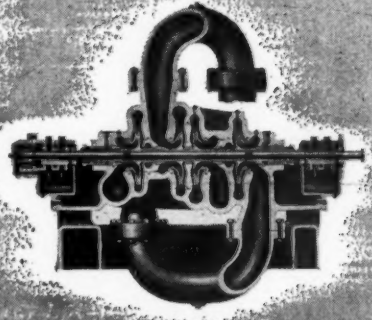


Built by De Laval in 1902

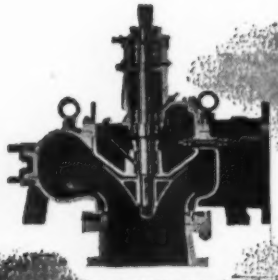
Modern De Laval centrifugal pumps represent the culmination of more than 45 years of continual improvement and perfection. This long period of concentration upon the problems of centrifugal pump design and application places at the user's command a complete line of modern, high quality pumps and a vast store of knowledge concerning pump application problems.



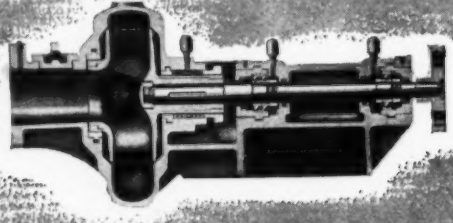
SINGLE STAGE, DOUBLE SUCTION PUMP



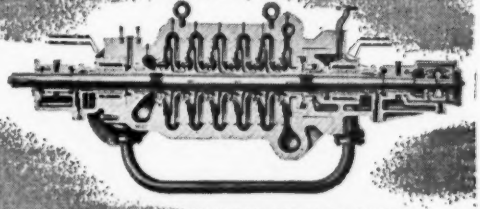
FOUR STAGE, OPPOSED IMPELLER PUMP



MIXED FLOW PUMP



CLOGLESS PUMP



HIGH PRESSURE, MULTI-STAGE PUMP

GP-1

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER • DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON • KANSAS CITY • LOS ANGELES • MONTREAL
NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TORONTO • TULSA • VANCOUVER • WASHINGTON, D. C. • WINNIPEG

POWER

A McGRAW-HILL PUBLICATION

N O WYNKOOP, *Publisher* P W SWAIN, *Editor*

L N ROWLEY, *Managing Editor*

Associate Editors:

F A ANNETT E W FELLER B G A SKROTZKI

Assistant Editors: J L KING J C McCABE C F SANDERS

Art Editor: C F MARSCHALEK

Business Manager: B E SAWYER

Washington: D D Hogate *Atlanta:* Earle Mauldin

WORLD NEWS OFFICES: *London, Paris, Berlin, Moscow, Prague, Shanghai, Bombay, Mexico City*

MARCH 1947 VOLUME 91, NUMBER 3

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURE ARTICLES

Raw-water softening experience in Canada's largest steam plant... 64 ⟶ ◀ ◀ ◀ ◀ ◀
Electrical angle determines load limit on motor and generator..... 68 ⟶ ◀ ◀ ◀
How specific speed affects centrifugal-pump performance..... 71 ⟶ ◀ ◀ ◀
Soot removal: an operating must—second in a series..... 74 ⟶ ◀ ◀
Steam-jet air evacuators make vacuum during power-plant starting. 76 ⟶ ◀ ◀ ◀
Boiler blowdown, like a hole in your pocket, can waste income..... 80 ⟶ ◀ ◀ ◀
Water power: cornerstone of Sweden's industrial development.... 82 ⟶ ◀
Proper fan installation reduces operating and maintenance costs.. 85 ⟶ ◀ ◀
Power generation highlights AIEE hydroelectric session..... 88 ⟶ ◀ ◀ ◀ ◀ ◀
Must diesel engines smoke?..... 92 ⟶ ◀ ◀
C Brooks Hudson: a power personality..... 95 ⟶ ◀
New equipment displayed at first electrical engineering show..... 98 ⟶ ◀ ◀
Scraper equipment stockpiles coal for utility..... 102 ⟶ ◀ ◀
Australia gets topping unit: plans 10-year power development.... 103 ⟶ ◀ ◀
Twenty men equal one horse, says C M Ripley..... 104 ⟶ ◀
Metal spray restores original efficiency of turbine seal rings..... 106 ⟶ ◀ ◀

THE OPERATING ENGINEER

Avoid explosive hazards in feedwater heaters..... 107 ⟶ ◀ ◀
Practical aids to plant operation..... 110 ⟶ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀
Reader's problems ..... 114 How to — ..... 124 ⟶ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀
Pump Q & A ..... 118 Math tips ..... 126 ⟶ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀
Water-treatment question box 122 Engineer's bookshelf ..... 128 ⟶ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀

OTHER DEPARTMENTS

Plant equipment ..... 130 George Edwards ..... 140 ⟶ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀
Data sheet ..... 138 Power news ..... 144 ⟶ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀ ◀

Cover photo, courtesy Westinghouse Electric Corp.

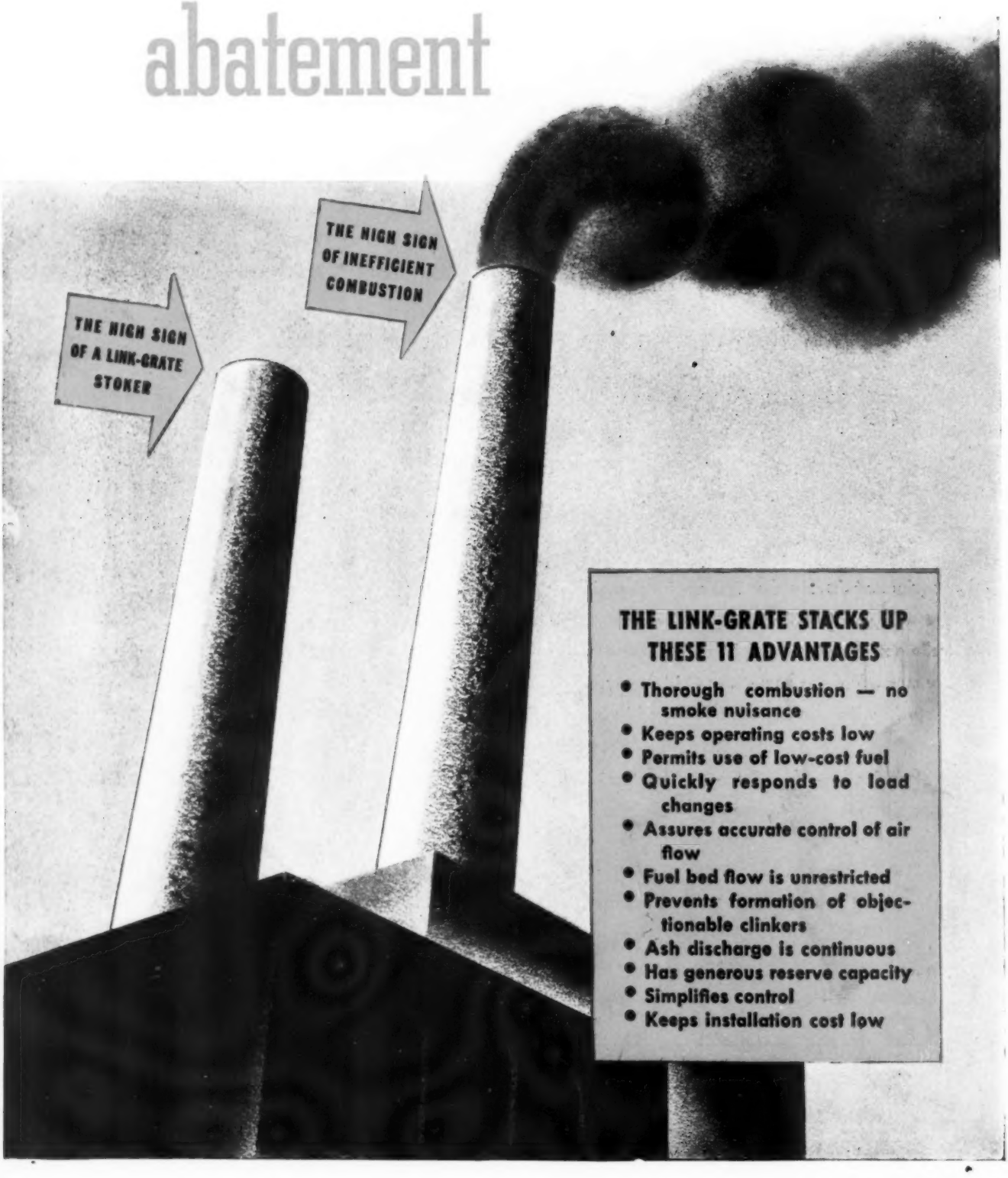
VOLUME 91, NUMBER 3 • ABC • ABP •

COPYRIGHT 1947 by McGRAW-HILL PUBLISHING CO., INC. • ALL RIGHTS RESERVED

James H McGraw, Founder and Honorary Chairman; James H McGraw, Jr, President; Curtis W McGraw, Senior Vice-President and Treasurer; Joseph A Gerardi, Secretary; Nelson Bond, Director of Advertising; Eugene Duffield, Editorial Assistant to the President; J E Blackburn, Jr, Director of Circulation • DISTRICT MANAGERS: New York, W W Quarles; Philadelphia, C R Long; Cleveland, F B Godley; Chicago, C Boughton; Boston, C L Morton; St Louis, G G Sears • PUBLICATION OFFICE: 99-129 Broadway, Albany 1, N Y • EDITORIAL AND EXECUTIVE OFFICE: 330 W 42nd St, New York 18, N. Y. • Cable Address: "McGrawhill New York" • DISTRICT OFFICES: 520 Michigan Ave., Chicago 11; 8 Post St, San Francisco 4; National Press Bldg, Washington 4; Architects Bldg, Philadelphia 3; 738-9 Oliver Bldg, Pittsburgh 22; 1510 Hanna Bldg, Cleveland 15; 2980 Penobscot Bldg, Detroit 26; Continental Bldg, St Louis 8; 1427 Statler Bldg, Boston 16; 1011 Rhodes-Haverty Bldg, Atlanta 3; Pacific Finance Bldg, Los Angeles 14; Aldwych House, Aldwych, London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index • POWER issues its own index annually; copies are available on request to the editorial office, 330 W 42nd St, New York 18.

Three cheers for smoke abatement

...from your fuel cost sheets



THE LINK-GRATE STACKS UP THESE 11 ADVANTAGES

- Thorough combustion — no smoke nuisance
- Keeps operating costs low
- Permits use of low-cost fuel
- Quickly responds to load changes
- Assures accurate control of air flow
- Fuel bed flow is unrestricted
- Prevents formation of objectionable clinkers
- Ash discharge is continuous
- Has generous reserve capacity
- Simplifies control
- Keeps installation cost low

2...from your Smoke Inspector

3...from your neighbors

Get all 3 with a Westinghouse Link-Grate Stoker

Smoke abatement means much more to you than to an outsider interested only in cleanliness. To you, it means more steam per pound of coal—more of your coal turned into heat, and less of it "up the flue" as soot.

You get these advantages with a Westinghouse Link-Grate Stoker because of its characteristic action. This action maintains a regular combustion rate by continuously processing the fuel bed to keep it porous. With this action, a positive motion at the rear of the stoker permits a uniform flow of coal over the underfeed section, to keep the burning lanes open.

In Link-Grate action, the grates first hinge upward to break open the fuel bed and let low-pressure air flow through the grates. The reverse movement of the grates crumbles and conveys the burning fuel.

Another effect of this Link-Grate action is the continuous ejection of the ash off the discharge plate—to do away with periodic dumping and to reduce labor costs. Clinkers are not a problem.

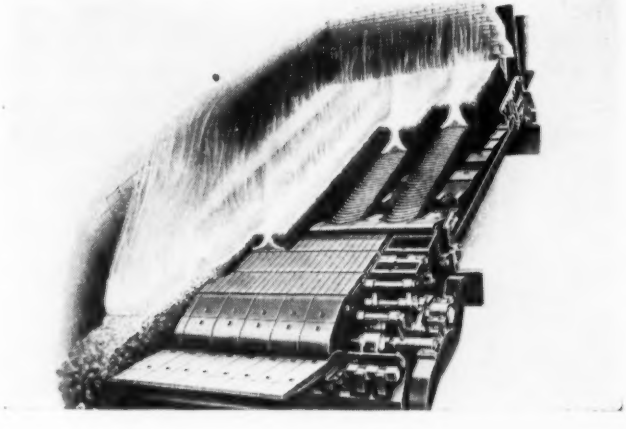
Since this action keeps the fuel bed always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

Get the complete information about the Link-Grate before you make another investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-50470

Show Link-Grate Movies in Your Own Office

A 15-minute sound moving picture has been produced to show in detail the operation of a Link-Grate Stoker. Whether you can visit an actual Link-Grate Stoker in operation or not, this interesting 16 mm. film will show you its action and explain its points of superiority while you sit at your desk. To borrow a print of this film for your own private showing, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Link-Grate STOKERS

Water is an essential processing material in a paper mill, and both the dependability and the purity of the supply must be carefully safeguarded. A well-known Wisconsin paper company followed a time-proven method when they installed a 36-inch OD pipe to carry raw water to the filter plant, using Byers Wrought Iron. The pipe was fabricated from Byers Wrought Iron plates by James G. Heggie Manufacturing Company.

There is plenty of engineering evidence, from various sections of the country, to support this choice of material. In Pennsylvania, a 50-inch water line is still in service and operating under 135 pounds pressure, after a period estimated at from 60 to 79 years, and only one leak has ever been reported. In California a 200-foot length of 44-inch OD wrought iron line was removed after 54 years service. It was in such good condition that it was placed in stock for making replacements. These are only two of many remarkable records that have been reported.

Wrought iron's durability and dependability in services like these is due to its unusual structure and composition, which are duplicated by no other material. Tiny fibers of glass-like silicate slag, 200,000 or more to the square inch of section, are threaded through the main body of high purity iron. These fibers act like baffles, in halting and dispersing corrosive attack, and so discouraging pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

A number of historic water lines, and a number of modern installations, are illustrated and described in our bulletin, "Wrought Iron for Underground Services." If you would like a copy, just write.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

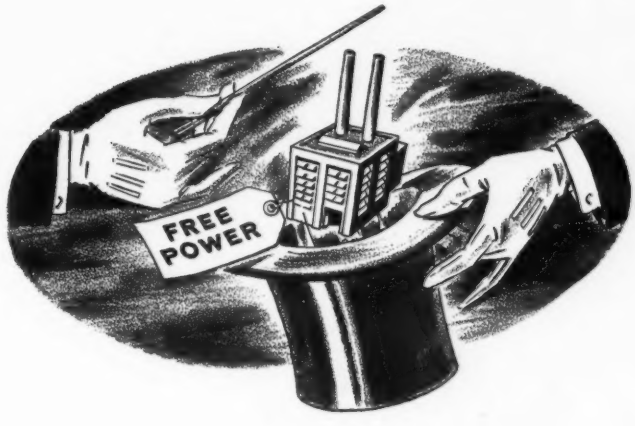
GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • MARCH 1947 • ESTABLISHED IN 1882



CHEAP FUEL VS CHEAP POWER

EVERY ENGINEER KNOWS that fuel is a mere fraction of the cost of delivered power—far exceeded by the total of such other costs as plant fixed charges, transmission and distribution costs. But many non-engineers have never seen it that way. Too often doctors, lawyers, preachers, mechanics, politicians, statesmen and school teachers assume that their power bills contain nothing much but fuel and profit.

This delusion has endured for decades, and is largely responsible for the well-intentioned public support of many uneconomical hydro projects.

Now this same overemphasis on fuel cost has begun to confuse public thinking about the future of atomic power. Hearing that the uranium fuel to make a kilowatt hour may cost much less than coal, many otherwise intelligent people conclude that atomic power will therefore be very cheap.

For a current sample of such "thinking" let's review a recent symposium in which leading social scientists attempted to explore the human implications of atomic power.

Sounding the keynote of this fantastic session, the first speaker announced that "atomic power will soon give the world power and commodities of all kinds in unlimited quantity at practically zero cost."

The lone engineer on the program, next man up to bat, tried to inject a little sanity into the proceedings. He reminded the group that uranium is merely a new heat source, replacing the coal and oil now used to make power. The atomic power plants will still need turbines, generators, condensers and electrical equipment. The present boilers will be replaced by even more costly uranium piles and heat exchangers. The piles will require elaborate controls and a complex chemical plant for the removal of fission products.

The engineer showed why there will be no saving in transmission and distribution. Giving uranium every break, there is no way it can save more than a fraction of the 0.4 cent now spent for coal to make a kilowatt hour. Also, he revealed the absurdity of "free goods" even if power could be free.

Nobody paid any attention to these common-sense observations. The debate rolled on in the style of Alice in Wonderland. A nationally known economist made many scholarly observations on ancient and modern times, but said nothing bearing on the meeting's subject.

A distinguished liberal statesman argued for the "good life" and an "economy of plenty." He implied that uranium is the key to both, but neglected to explain how. Another speaker expressed his joy at the early prospect of "free power and free goods."

Driving home after the meeting, the engineer asked himself whether this was indeed a sample of the way America's "best minds" are attacking the great social problems of our times. "If so", he mused, "what are the chances of finding sensible solutions?"

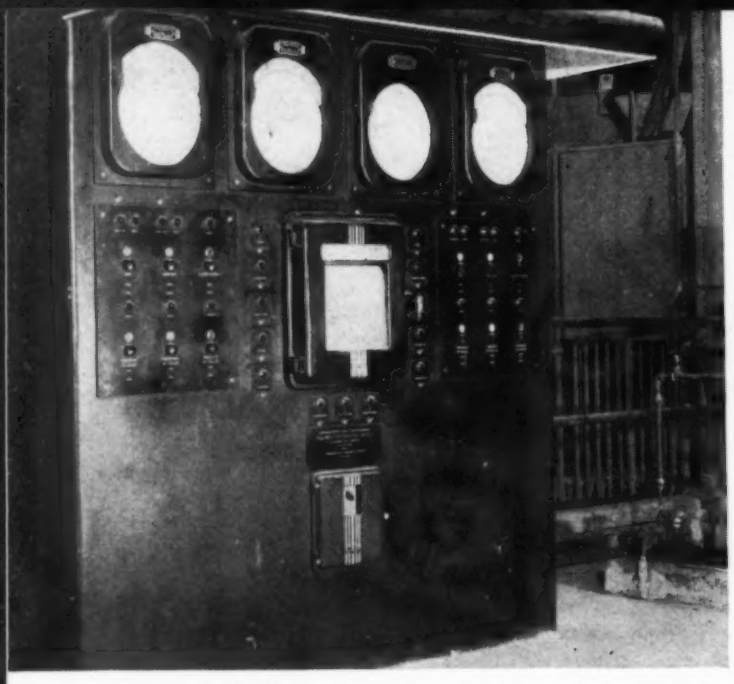


Fig. 1—Central electric control panel for lime, soda ash, sulphuric acid, phosphate feed, also alarm-signal system

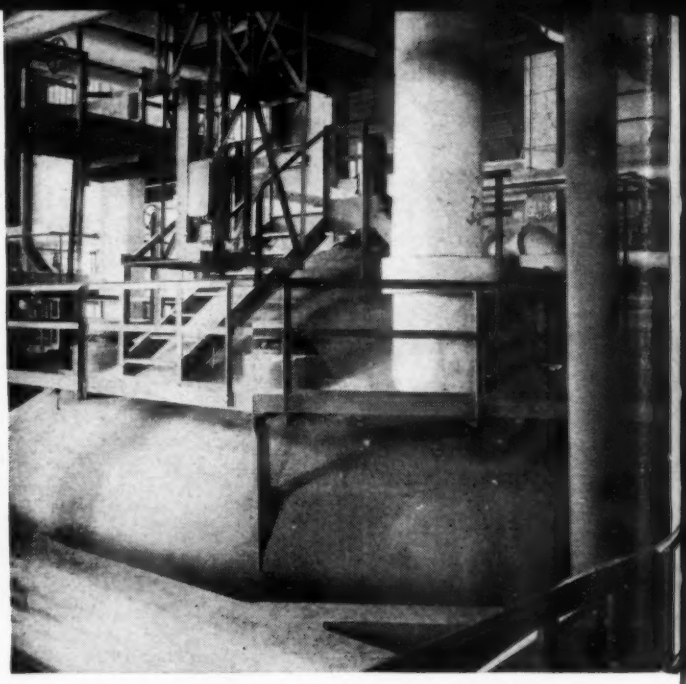


Fig. 2—Top of one of two steel-constructed 800,000-lb-per-hr, hot-process-lime and soda-ash, raw-water softeners

Raw-Water Softening Experience in Canada's Largest Steam Plant

Equipment, its operation, troubles corrected in system designed to treat 1,600,000 lb per hr of raw river water for six 430-psi 630-F boilers. James E Lewis, feedwater supervisor of Polymer Corp, in the first of two articles, covers raw-water treatment

► Polymer Corp, Ltd, of Sarnia, Ont., a Canadian government-owned synthetic-rubber plant, started operation Sept 1943. It has five watertube boilers installed and room for a sixth, the largest units in Canada. Each boiler is rated 275,000 lb of steam per hour with 220-F feedwater, and 308,000 lb when feedwater is heated to 340 F. Steam conditions are 430 psi and 650 F (see Power, Aug 1945). In a boiler plant operating under these conditions, feedwater quality is one of the most important factors in successful performance.

H G Acres Co, consulting engineers, cooperating with Hall Laboratories, Inc, and their Canadian representatives, Dominion Flow Meter Co, feedwater consultants, selected the feedwater-treating system. Considering that the system was installed under wartime conditions it has been simple to operate, adaptable and inexpensive. Ordinarily St. Clair River water (average analysis in Table I, p 66) permits using any one of several different treating systems. Suspended solids, organic material and oil contamination become high at times, thereby requiring a treating system to handle these adverse conditions.

In addition to the requirements of a good water-treating system for boiler protection, characteristics of the process-steam system had to be taken into account. Because of war restrictions, steam pressures and temperatures for power generation were more complicated than they normally would be. A considerable part of process steam was to be superheated to 1400 F in a gas-fired superheater; therefore steam quality had to be considered.

With quantity and quality of condensate returns from process units uncertain, and with only 10% of feedwater requirements obtainable from power-plant auxiliaries, makeup was based on 90% total feedwater for six boilers, rated 1,600,000 lb of steam per hour. An external hot-process lime-soda softening system, followed by filtration, acid feed, deaeration, soda-sulphite injection and internal sodium-hexametaphosphate feed, was selected as best suited to boiler and process requirements.

Softeners. Two 800,000-lb-per-hr hot-process-lime and soda-ash softeners are steel constructed for 18-psi working pressure, Fig. 2 and 4. Raw water passes to either softener through a flow-meter orifice and an 8-in. double-disk air-operated water-inlet valve, controlled by an external float box. Vent condensers on the softener roof relieve noncondensable gas to the atmosphere. Rosette sprays distribute water in the softener steam space where it is heated within 2 to 4 F of saturated-steam temperature.

Under normal operating conditions, steam pressure in the softener is maintained at 7 psi by an automatically controlled valve between the 15-psi steam header and softener. Lines with orifices connect between the deaerators and the softeners' 7-psi steam header to insure adequate steam flow through the vent condensers for heating. Flash steam from the return condensate tanks also passes to the 7-psi header through a balancing line, shown in next article.

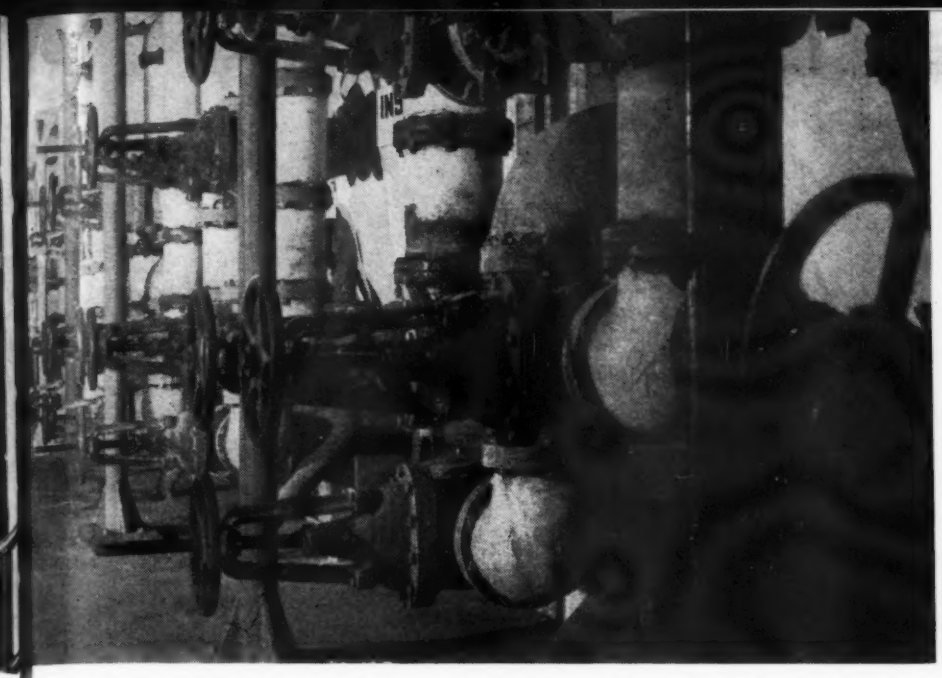


Fig. 3—Filter-valve nest is arranged for backwashing with treated water from the softeners' header or with treated and filtered water from filters' header

Vacuum breakers and pilot-actuated automatic-overflow traps provide safety protection. A 4-speed motor-operated stirring mechanism installed in each softener aids precipitation and mixing of chemicals. Hydraulically operated, electrically controlled desludging valves on the softener cone bottoms, Fig. 7, remove precipitated sludge. If necessary, it is possible to bypass these valves.

The softeners, which have operated satisfactorily, reduce the hardness to less than 0.8 grains per gallon, or less than 13.7 ppm as $CaCO_3$. Their maintenance has been insignificant except for cleaning precipitated scale semiannually from internal surfaces.

Chemical Feeding. Hydrated lime and soda ash are each mixed separately with raw water in four welded steel-plate tanks that have vertical propeller agitators for mixing and circulating chemicals. Water-ejector dust evacuators reduce liberated chemical dust when the tanks are charged. Electrical control and proportional-feeder equipment regulate chemical flow to the softeners through continuously operated centrifugal pumps.

Originally chemical solutions were fed to an annular space around the raw-water inlet pipes in the softeners. As the chemical solution flowed downward it mixed with spray from the rosette heaters. Both lime and soda ash precipitated from solution within these annular spaces, causing resistance to steady flow, and eventually plugging them. These spaces could not be cleaned while the softeners were in operation. Chemical deposits also accumulated in large quantities on the softeners' roof, being carried there with the spray from the rosette heaters.

Fluctuations of softener control raised suspicions that these chemical deposits dropped off and caused otherwise unexplained changes in amount of chemicals required for steady operation. To overcome this difficulty, chemical-feed lines have been rearranged to feed the chemical solution directly to the softener slurry at its surface, and have thereby rectified the trouble.

Filters. Softened water flows by gravity to a battery of eight horizontal steel filters connected in parallel, Fig. 4, designed for 50-psi working pressure. Anthracite filtering material, arranged in graded layers, forms about a 3-ft bed in each filter, which removes insoluble suspended solids coming from the softeners. Treated-and-filtered water collects at the filter's bottoms in a concrete embedded header equipped with lifter strainer valves. In each filter, surface washers aid backwashing. Treated water, boosted to 50-65 psi by a centrifugal pump, operates the agitators. The filter valve nest, Fig. 3, is so arranged that backwashing can be done with treated water from the softener-effluent header, or by treated and filtered water from filter-effluent header.

During backwashing with either method, the header pressure forces water in a reverse direction to normal flow through the filter bed to the suction header of the backwash pumps, returning the slurry to the top of the softeners. Sludge from the backwash water then precipitates through the sedimentation tank to be carried away to the sewer by the sludge blowoff valve.

Sodium-Silicate Feed. Sodium silicate is fed, supplementary to the water-treating system. This somewhat uncom-

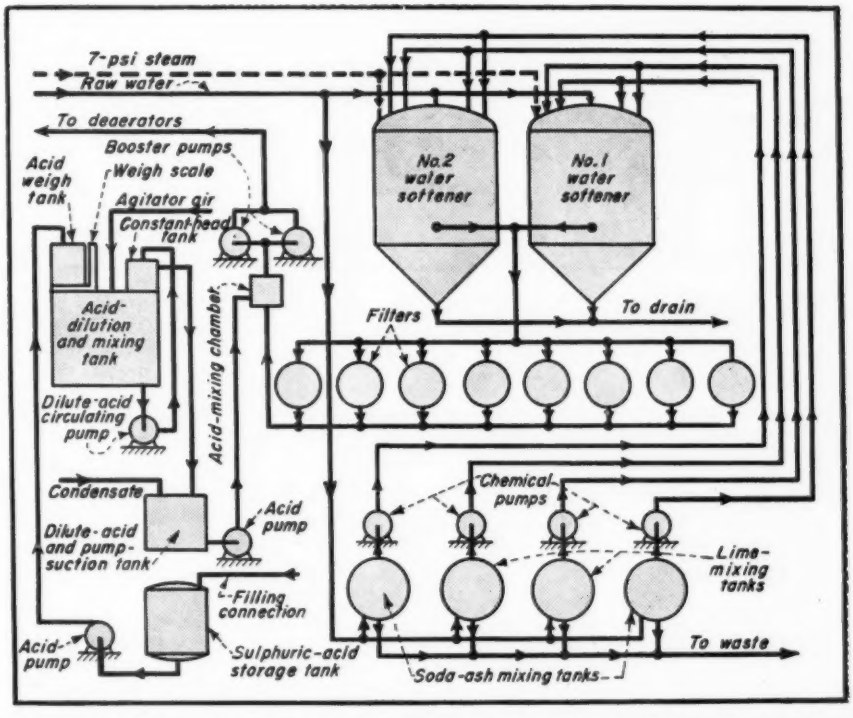


Fig. 4—Simplified diagram of raw-water softener system including lime-mixing, soda-ash-mixing tanks and sulphuric-acid feeding equipment to point where water goes to deaerators. Boiler-water half of the diagram in next article

mon procedure was initiated on advice of water-treating consultants when they analyzed sludge deposits that formed in the boilers after a few months' operation. Table III gives the analysis of one of the early samples of sludge. By X-ray examination, the analysis showed that the deposits were essentially calcium phosphate present in the hydroxyapatite form, and magnesium silicate. These are the desirable forms of precipitating calcium and magnesium, and they are the most readily maintained in suspension in properly treated boiler water to obtain maximum removal of solids from the boilers by the continuous blowdown system.

The analyses also showed a somewhat greater ratio of magnesium to silica than required for precipitation of all magnesium, as magnesium silicate existed. That is, some magnesium phosphate and magnesium hydroxide were present, as indicated by the combined analyses of the sludge, as shown in Table III.

While magnesium, precipitated as phosphate or hydroxide, does not form a hard scale, it does tend to be more adherent and binding than when precipitated as magnesium silicate. As all magnesium precipitated in the boiler water was not forming as magnesium silicate, the indication was that it would be advantageous to add more silica to the water supply. Greatest advantage from adding a small amount of silica at the softener would probably be to increase magnesium precipitated as magnesium silicate. As a result, less magnesium hydroxide would be precipitated, and filters would probably be maintained cleaner.

In Table I, average analysis of river water shows silica as 2 ppm by color and 7 ppm gravimetrically. This indicates 2 ppm by color present in the water in a dissolved form and 5 ppm present as suspended matter. This leaves only 2 ppm of dissolved silica available for reaction with magnesium in the softener. As this is not enough the deficiency was remedied by adding soluble silicate.

Trouble was experienced with filter backwashing when sludge-sample analyses were being studied. Filters were inspected and found to have a heavy build-up of sticky sludge, which prevented the rotary agitators from functioning successfully and caused difficulties with backwashing. To rectify this about 3 ppm of silica was added by feeding the equivalent, or 10 ppm of sodium silicate (water-glass), in solution with the soda-ash charge.

In the treated-water analysis of Table I, which was determined while feeding sodium silicate, both the colorimetric and gravimetric silica results are the same, 2 ppm indicating that all silica is present in dissolved form. Thus, most of the silica, which was contained in the raw water originally, plus the silica added at the softener, has been precipitated and separated in the softener and filters. The residual magnesium in this water is quite low, 0.4 ppm, but sufficient to precipitate magnesium in the boiler water as magnesium silicate, which would be present as part of the suspended matter or sludge in the boiler water.

A typical analysis of boiler water, given in Table II, lists the concentrations of silica as 38 ppm, mostly in soluble form as indicated by the colorimetric test. This concentration of silica is satisfactory for the boilers installed in the plant.

Feeding of sodium silicate has been successful. Subsequent cleaning and backwashing of the filters have been much less troublesome. Boilers are cleaned only by water-hose washing to remove soft sludge deposits, and there is no evidence of internal scale formation on any of their parts.

Sulphuric-Acid Feed. Sulphuric acid (98%) is delivered at the plant in tank cars, originally unloaded by a gear

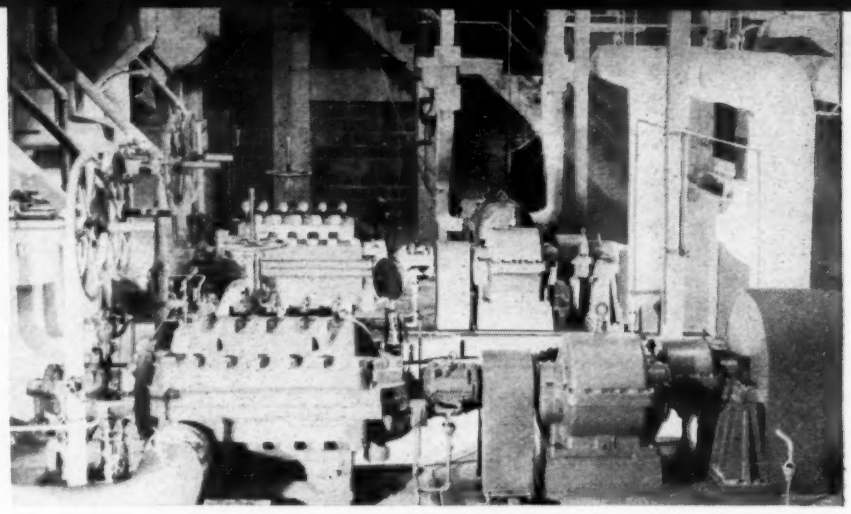


Fig. 5—Two, 1,000,000-lb-per-hr boiler-feed pumps driven at 1800 rpm by 1000-hp 4000-rpm turbines, operating on 400-psi 650-F steam, exhausting at 155 psi

TABLE II—BOILER WATER ANALYSIS

A reading, ml N/30 (HCl)		14.8
B reading, ml N/30 (HCl)		12.0
		Ppm
Phosphate	(PO_4) gage	55
Sulphate	(SO_4) gage	425
Chloride	(Cl)	80
Dissolved silica	(SiO_2) color	34
	gravimetric	38
Aluminum	(Al) buffer	Negligible
Total solids		1496

TABLE I—ANALYSIS OF RAW AND TREATED WATER

		Raw water from St. Clair River		Treated water before acid feed	
		Ppm	Epm	Ppm	Epm
pH value		7.4		10.0	
Hydroxide	(OH)	0	0.00	1	0.03
Carbonate	(CO_3)	0	0.00	28	0.93
Bicarbonate	(HCO_3)	124	2.03	0	0.00
Sulphate	(SO_4)	16	0.33	16	0.33
Chloride	(Cl)	7	0.20	5	0.14
Silica	(SiO_2) color	2	0.67	2	0.067
	gravimetric	7	0.233	2	0.067
Calcium	(Ca)	22	1.12	—	—
Magnesium	(Mg) gravimetric	5	0.38	—	—
	color	5	—	0.4	0.033
Soap hardness	$CaCO_3$)	75	1.50	10	0.20
Suspended solids		high	—	2-4	—
A reading, ml n/30	(HCl)	—	0.0	—	1.5
MO reading, ml n/30	(HCl)	—	6.1	—	2.9
Soap hardness	($CaCO_3$) ml	—	4.4	—	0.6

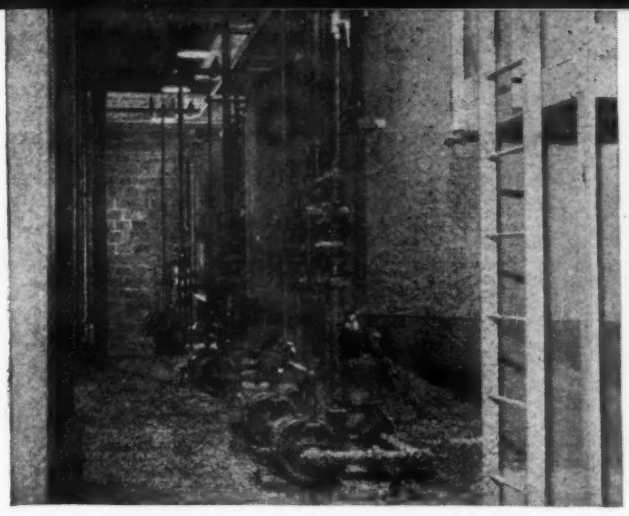


Fig. 6—Hydrated lime and soda ash are mixed separately with raw water in four steel tanks, pumped to softeners

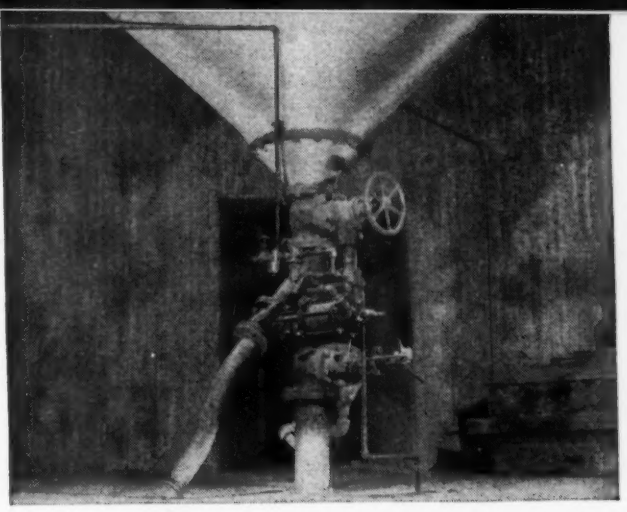


Fig. 7—Hydraulically operated, electrically controlled valves on the softeners' cone bottoms remove the sludge

pump and stored in an all-welded steel tank. We have abandoned the pump in favor of compressed air for unloading the acid cars. A centrifugal booster pump transfers the concentrated acid to the weighing tank, which has a useful capacity of 1000 lb of H_2SO_4 and sets on a weigh scale, Fig. 4.

Weigh tank and scales set on top of a welded-steel lead-lined acid-dilution and mixing tank with 1200-gal useful capacity. Air agitation thoroughly mixes the solution. Acid is diluted to about a 2.5% solution, and is recirculated through a steel lead-lined constant head tank by a hard-rubber centrifugal pump.

The head tank, located about 2.5 ft above a straight-line-flow acid-solution control valve, maintains a constant head on this valve, so flow to the dilute-acid-pump suction tank is proportional to valve opening. Dilute-acid-solution flow is regulated from the head to the suction and proportioning tank by a control valve, positioned by a valve-motor operator-controller.

A flowmeter regulates valve position according to flow passing to the deaerators, and a pH recorder-controller corrects the control-valve position for deviation of the treated-water pH from a predetermined point. The measured dilute-acid solution, flowing to the pump-suction and acid-proportioning tank, is further diluted with cooled condensate, which is maintained at constant level by a float valve. Acid-resisting pumps deliver the acid solution (about 1%) to the lead-lined mixing chamber in the treated-water line between the filters and the deaerator-pump suction header. Sample of treated-water passes through a unit wired to a recorder-controller for automatic control.

Sulphuric acid is fed to the system mainly to reduce the possibility of forming carbonate deposit in the stage heaters and feed-pump lines. The acid reduces the pH of the treated filtered water from about 9.5-10.5 to 8.3-8.5. This drop in pH changes the carbonate in the water to bicarbonate, releasing carbon dioxide, which is removed in the deaerating heater. Some decomposition of bicarbonate to carbonate will also occur at deaerator temperature, occasioned by the removal of CO_2.

Sodium sulphate in the boiler water is increased by the feeding of sulphuric acid. This ordinarily provides sufficient sulphate to meet the ASME recommended ratio of 3:1 sodium sulphate to total sodium hydroxide, plus sodium-carbonate alkalinity calculated as equivalent sodium carbonate.

ASME Suggested Rules, Care of Power Boilers, 1943 states that operating evidence at this point shows no embrittlement in boilers designed to operate at or above 400 psi with welded, forged or internally calked riveted drums. It refrains from suggesting any specific chemical control of the feedwater for such boilers. In view of these suggestions, and because our boilers are all welded, stress relieved, and operating above 400 psi, it is not imperative to adhere to the 3:1 ratio of sulphate to alkalinity. Feeding of tannin or nitrate is feasible with this feed-ratio treating system if it is necessary to protect against embrittlement.

A second article will deal with deaeration, sodium-sulphite feed, phosphate feed, continuous blowdown system, control panel, alarms, operation and control of the treating system.

TABLE III—ANALYSIS OF EARLY SLUDGE SAMPLES

DEPOSITED IN THE BOILERS AFTER A FEW MONTHS' OPERATION

Microscopic examinations:

Major: Rod-shaped calcium phosphate
Minor: Magnesium silicate, hydrated ferric oxide, magnesium phosphate, traces of anhydrite and calcium silicate

Chemical examination:		*Percent*	*Equivalent*
Sulphur trioxide	(SO_3)	1.1	0.027
Carbon dioxide	(CO_2)	Negligible	—
Phosphorus pentoxide	(P_2O_5)	27.1	1.14
Silica	(SiO_2)	11.5	0.38
Iron oxide	(Fe_2O_3)	6.1	—
Calcium oxide	(CaO)	33.1	1.18
Magnesium oxide	(MgO)	15.9	—
Sodium oxide	(Na_2O)	Not determined	—
Total ignition loss		4.4	0.49
Oil		No evidence	—
Sintering		None	—

Combined form:	*Percent*
Hydroxyapatite ($3Ca_3(PO_4)_2 \cdot Ca(OH)_2$) (form of calcium phosphate)	6.14
Magnesium phosphate ($Mg_3(PO_4)_2$)	3.2
Magnesium silicate ($3MgO{-}2SiO_2$)	26.5
Magnesium hydroxide ($Mg(OH)_2$)	4.1
Magnetic oxide of iron (Fe_3O_4)	6.1

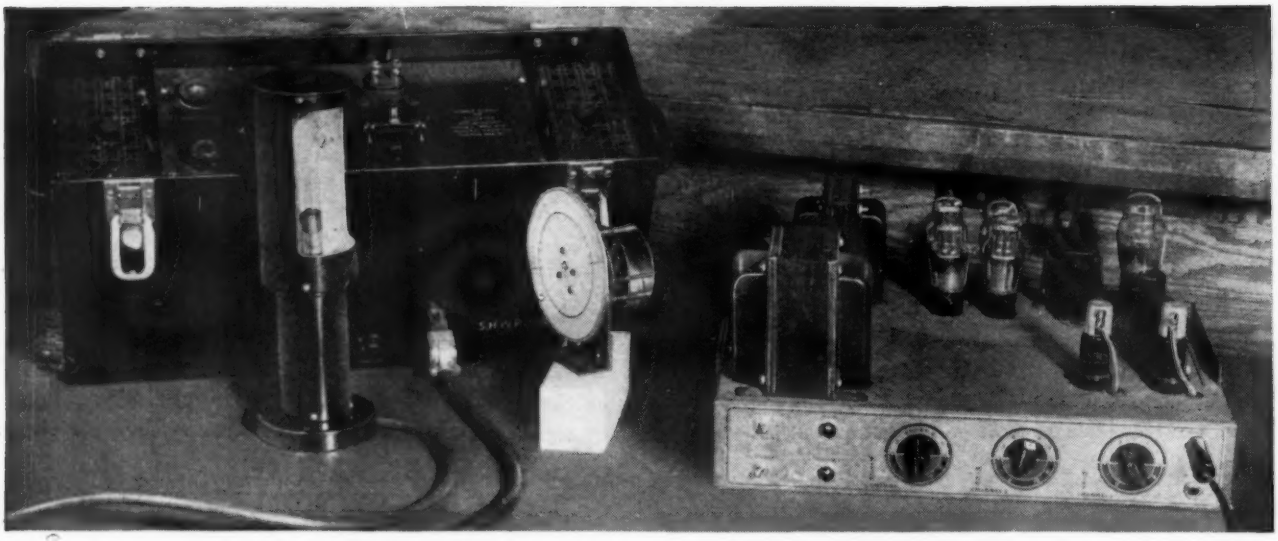


Fig. 1—Apparatus gives visual indication of load angle for a 35,000-kva single-phase hydro generator and large motor

Electrical-Angle Measurement on Motor And Generator Determines Load Limit

Before loading a 35,000-kva 25-cycle single-phase hydro generator to capacity by driving a 31,250-kva frequency-changer motor a visual study was made of electrical load angle between the two machines to determine stability at different loads

By K J GRANBOIS. *Safe Harbor Water Power Corp, Conestoga, Pa.*

▶ IN 1934 THE PENNSYLVANIA Water and Power Co began furnishing power to the Pennsylvania Railroad with a single-phase 25-cycle 35,000-kva 13.3-kv waterwheel-driven generator and a synchronous frequency changer. The latter is a single-phase 25-cycle 31,250-kva 13.3-kv generator, that is direct connected to a 3-phase 60-cycle 29,700-kva motor.

Field current on each of the 25-cycle generators was at that time limited by the relatively low bus voltage, which was required to maintain the desired trolley voltage. This voltage was held to 12,300 volts with a resulting low field excitation and, consequently, doubtful stability on the 25-cycle machines.

When railroad power demand was small, the capacitance of the lightly loaded 132-kv transmission lines further reduced the field excitation below that required at heavy load. At that time it was desirable to convert 25,000 kw of the 25-cycle hydro-generated power to 60-cycle through the frequency changer. Before the full-rated capacity of the 25-cycle equipment could be utilized, confirmation of loading limits was desired without creating an actual out-of-step condition between the 25-cycle single-phase machines. For this reason angular displacement was measured between rotors of the two machines under operating conditions.

ANGULAR DISPLACEMENT

When a synchronous generator is running at no load the magnetic flux between the rotor and armature takes the shortest path through the air gap. As the generator is loaded, the rotating field advances from its position at no load because of the shifting or stretching of the magnetic field, the amount of shift being a function of the load. In a synchronous motor under load the revolving field falls behind its position at no load.

The magnetic flux may be visualized as elastic springs, connecting the rotor and the armature or stator. When the generator is running unloaded, the springs are not stretched; as the generator becomes loaded, the springs stretch an amount depending upon the load. This analogy is shown in Fig. 5, where two springs are used to represent the magnetic flux.* The restoring action of the springs is commonly called synchronizing torque. In the case of a motor, the spring action is reversed in direction.

This load angle, or stretch of the spring, can be carried only to 90 electrical degrees, or one half of the pole pitch, without the machine becoming unstable or falling out of step. In order to run the machines well within the stability limits during the tests, an arbitrary load angle of 45 degrees was set for each machine, thus limiting the combined load angles of the generator and motor as measured to 90 de-

* Reprinted by permission from *Modern Turbines* by Newman, Keller, Lyons and Wales.

grees. It was expected that the angular displacement would divide equally between the two machines because the short-circuit ratios were approximately the same. Furthermore, the high short-circuit ratio indicated stiff magnetic coupling and high stability.

MEASUREMENT OF ANGLE

Many methods have been discussed for approaching this problem, such as current measurements with contactors on drive shafts, oscillograph records of phase displacement of voltage waves, rotor displacement by stroboscopic means and calculations from short-circuit ratios and performance curves. The following method was adopted for a quick and continuously visible observation of the angle between rotors of a synchronous motor and generator during load changes. To save time and labor, equipment already installed on the machines was used as far as possible. Fig. 1 shows apparatus assembled especially for the test. Existing, commercially available laboratory equipment was used, with one exception noted below.

The generator has a gear-driven direct-current tachometer magneto on the drive shaft. Its output is 4 volts with a 140-cycle commutator ripple superimposed when the main shaft is turning at rated speed of 100 rpm. The dc was bucked out with a battery, and the ac ripple amplified by an audio amplifier to about 150 volts to energize a synchronous clock motor. Fig. 2 shows a schematic layout of the apparatus. The clock motor was modified to drive a revolving pointer (as shown in Fig. 4) through suitable gears at 1500 rpm. This pointer speed was selected so that one mechanical degree on the pointer scale would be equal to one electrical degree of the 30-pole 100-rpm generator rotor. Therefore, one revolution of the main generator shaft, or 360 mechanical degrees, represents one revolution of 15 pairs of poles, and equals 15x360 electrical degrees. One generator-shaft revolution equals 15 revolutions of the pointer, and also equals 15x360 electrical degrees.

Thus 1/360 revolution of the pointer, equals one electrical degree, therefore one mechanical degree of pointer equals one electrical degree of the main generator.

The revolving pointer was viewed through a window in a housing inclosing both the pointer and a stroboscope lamp. The stroboscope was flashed once every revolution of the frequency-changer shaft from a 5-cycle direct-connected tachometer magneto, making one flash for every five revolutions of the pointer. When the two 25-cycle machines were synchronized the pointer appeared to stand still. At no load and unity power factor, the dial behind the pointer was adjusted manually until the pointer stood at zero. Then, with this setting as a reference, the generator was loaded, and as power was fed through the frequency changer to the 60-cycle bus, the pointer appeared to move over the scale in a clockwise direction. This is the same direction of rotation as that of the clock motor used to drive the pointer, and also of the hy-

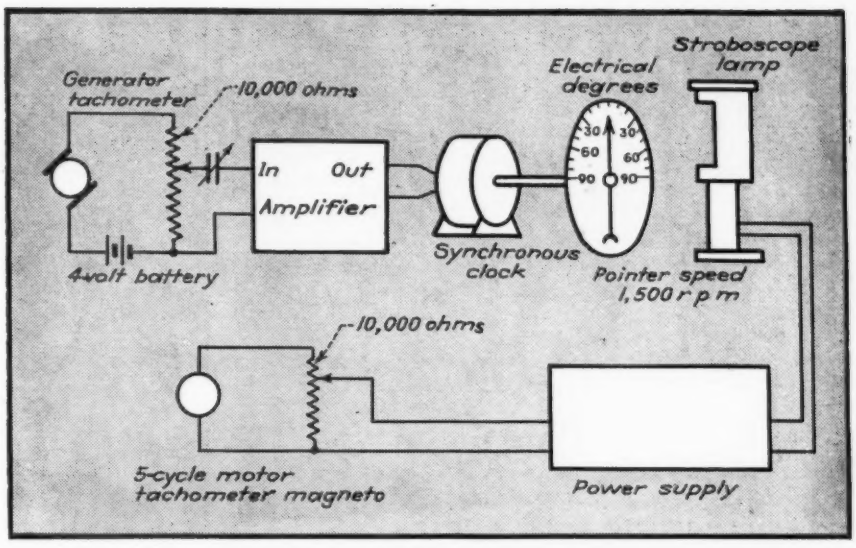


Fig. 2—Layout of load-angle test apparatus shown in Fig. 1. Internal connections to amplifier and power supply are omitted because units are standard

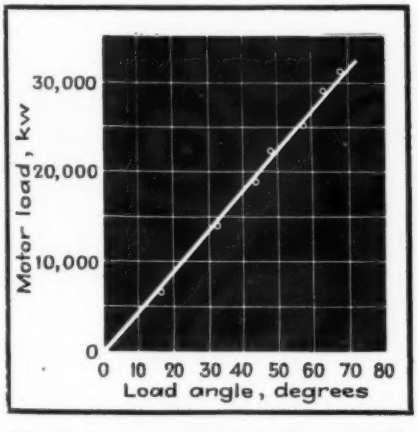


Fig. 3—Load angle displacement of 25-cycle generator and motor under load

TEST DATA OF FIELD CURRENT AND REACTIVE KVA ON EACH MACHINE

25-cycle generator				25-cycle motor				Railroad load		Load-angle electrical degrees
Kw	Reactive kva	Pf	Field current	Kw	Reactive kva	Pf	Field current	Bus kv	Kw	
8,380	2,500	95.8 lag	245	7,050	2,800	93.0 lag	200	12.3	1,330	16
15,350	1,000	99.7 lead	290	13,400	4,500	94.8 lag	200	12.3	1,950	30
15,300	1,000	99.8 lead	290	14,250	4,500	95.3 lag	200	12.3	1,050	32
20,280	2,000	99.5 lag	330	19,200	6,000	95.4 lag	200	12.3	1,130	43
24,000	3,000	99.2 lag	360	22,500	9,200	92.5 lag	210	12.3	1,000	49
26,220	2,000	99.7 lag	380	25,200	8,000	95.3 lag	220	12.2	1,020	56
30,700	5,000	97.7 lag	420	29,500	11,000	94.0 lag	240	12.2	1,200	63
32,400	600	98.3 lag	425	31,000	11,000	94.2 lag	270	12.2	1,400	67

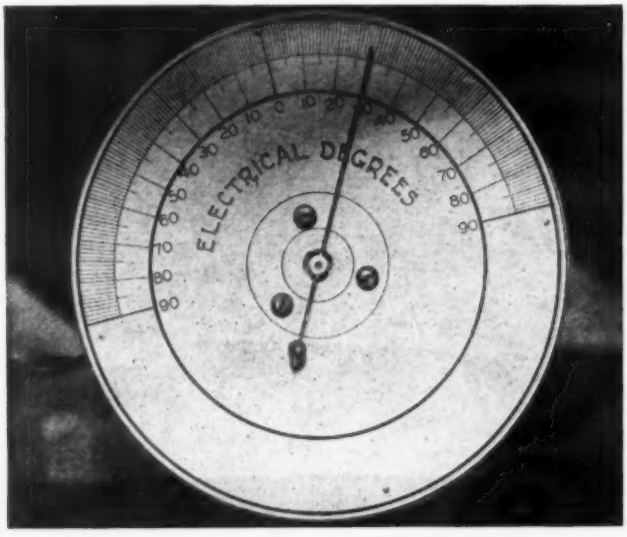


Fig. 4—Revolving pointer synchronized with generator appears to stand still by flash synchronized with motor

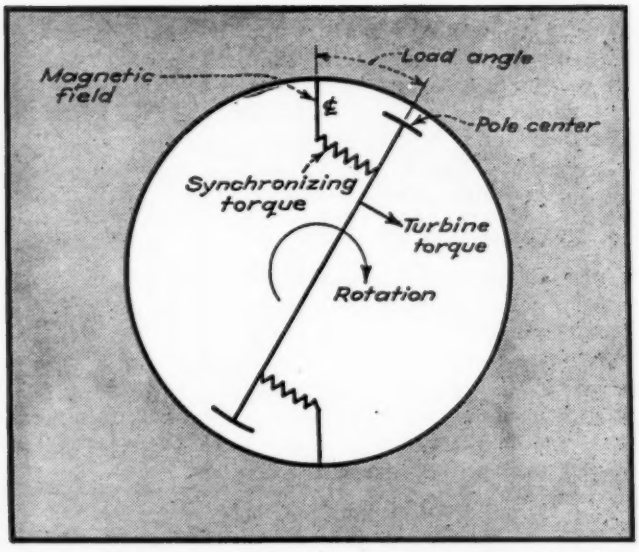


Fig. 5—Diagrammatical analogy of generator-field elasticity shows load angle and magnetic restraining torque

dro generator when viewed from above.

As the load angles increased, the hydro-generator rotor moved forward slightly, causing the pointer to advance. The rotor of the frequency changer moved backward, causing the lamp to flash later than at the time of no load. Thus the indications of the pointer gave the sum of the generator and the motor angles. These rotor displacements correspond to the spring stretch analogy referred to in Fig. 5.

TEST RESULTS

Curve of Fig. 3 shows test results of angular displacement vs load through the frequency changer at 12,300 volts with the automatic voltage regulators in service. Field current and reactive kva on each machine are shown in the table of test data on preceding page. The tests showed that even at reduced excitation the full capacity of the machines could be utilized. The instantaneous, visual method of measuring the power angle was entirely reliable and satisfactory.

The method employed to measure phase angle between the rotors is a good example of the results obtainable by utilizing characteristics that are not usually recognized in existing equipment. Considerable savings in this case were effected by taking advantage of two tachometer generators that were regularly installed on the two machines.

It Doesn't Pay to Be a High-Hat

By N L REA

Engineering Consultant, Service Engineering Div, General Electric Co

▶ ONE TIME IN UPPER INDIA the waterwheel erecting engineer had real trouble. One wheel out of the group insisted on hunting. The governor was always on the move searching for the right gate opening.

The engineer in charge was much impressed with his own importance and made no attempt to conceal his disgust for "the working classes."

One of the gang, an old-time New England mechanic named Charley, had grown up with the electrical industry, and resented bitterly the high-hat attitude of the engineer. One day he went to the Chief and said, "Why don't you send that stuffed-shirt engineer home? He's no good to you on this job!"

"What about the governor, Charley? It isn't satisfactory," the Chief replied.

"Send the engineer home and I'll fix the governor," said Charley.

"What's the matter with it?"

"Never mind. I won't say or do a thing until he is aboardship and far enough away so he can't get back. I can't work with him around."

A few days later the Chief came up to Charley and said, "Your friend sailed yesterday. Now let's see you keep your promise." Charley looked him straight in the eye. Then after a brief silence he said, "All right, put the wheel on 'hand control' and disconnect the governor. See that little inserted block that carries the end of the floating lever? The notch is a few mils nearer to one end of the block. We'll lift it out, turn it around, put it back, and then see what happens."

No sooner said than done, and the governor took over without a sign of hunting. The Chief was visibly impressed.

"Charley, how did you know that was the cause of the trouble?"

"Well," the old-timer replied, "I figured that must be the cause and sneaked down here about 2 a m one night when everybody, including the operators, was asleep. I swapped ends of the block, observed results, and swapped them back. That engineer can't high-hat me and get away with it. I know my job."

How Specific Speed Affects Centrifugal-Pump Performance

Alexander Brkich, Ingersoll-Rand engineer, explains what specific speed is, and shows how it affects pump size, shape, speed, cost, operating head, performance

▶A PROSPECTIVE BUYER may wonder why one centrifugal pump has a higher efficiency than another even though both are for the same service and have the same outward appearance. Or he may ask why one pump is single-stage while another for the same head is 4-stage. The answers to these and other questions are tied to "specific speed," the pump manufacturer's designation for the various designs.

Specific speed of a centrifugal pump's impeller is the speed in rpm at which a geometrically similar impeller would run if it were of a size to have 1-gpm capacity against 1-ft head. Briefly stated, specific speed is a relationship of pump speed, capacity and head as expressed in the equation:

$$N_s = \frac{\text{rpm}\sqrt{\text{gpm}}}{H^{3/4}}$$

where N_s equals specific speed, and H the head in feet per stage for which the

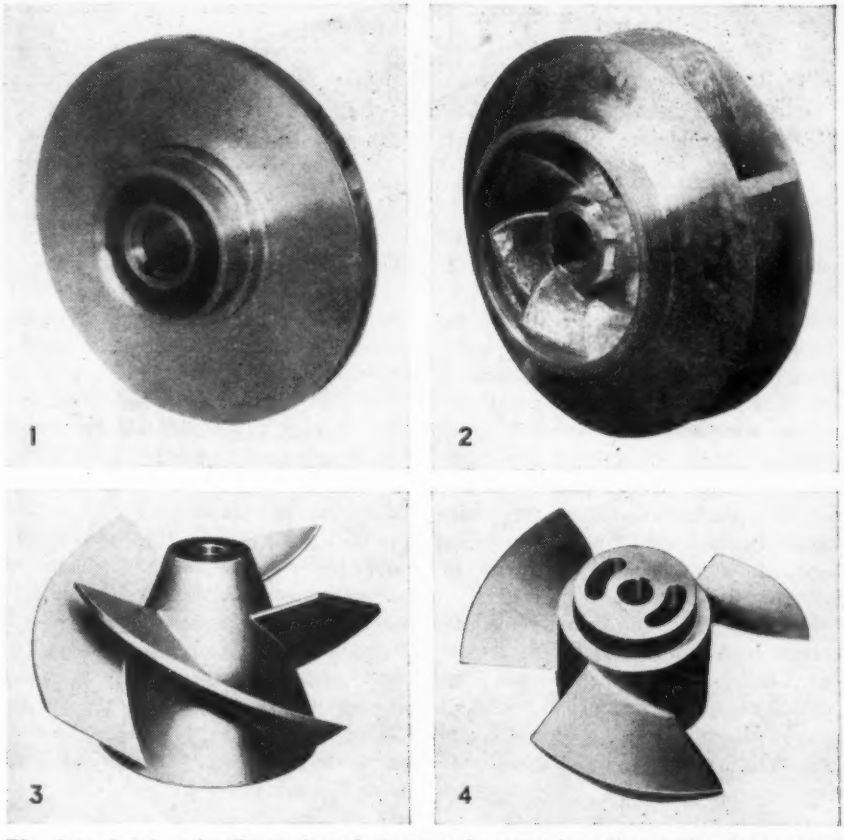
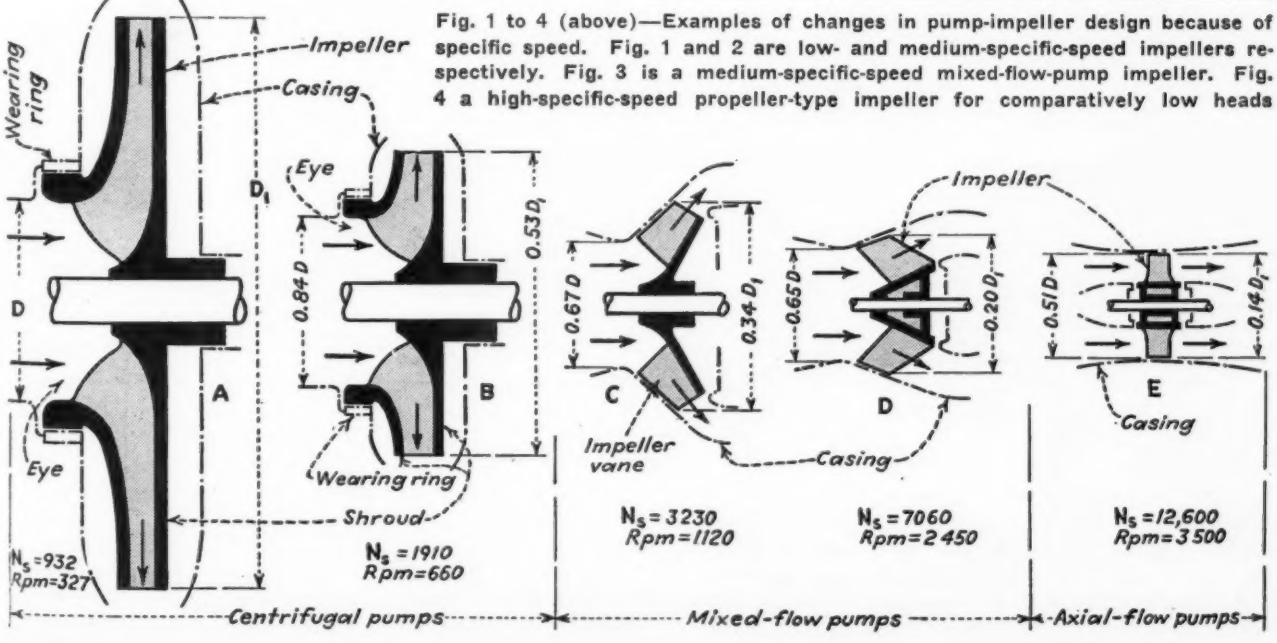


Fig. 1 to 4 (above)—Examples of changes in pump-impeller design because of specific speed. Fig. 1 and 2 are low- and medium-specific-speed impellers respectively. Fig. 3 is a medium-specific-speed mixed-flow-pump impeller. Fig. 4 a high-specific-speed propeller-type impeller for comparatively low heads

Fig. 5 (below)—Cross-sections of five pump impellers for same capacity but for different specific speeds



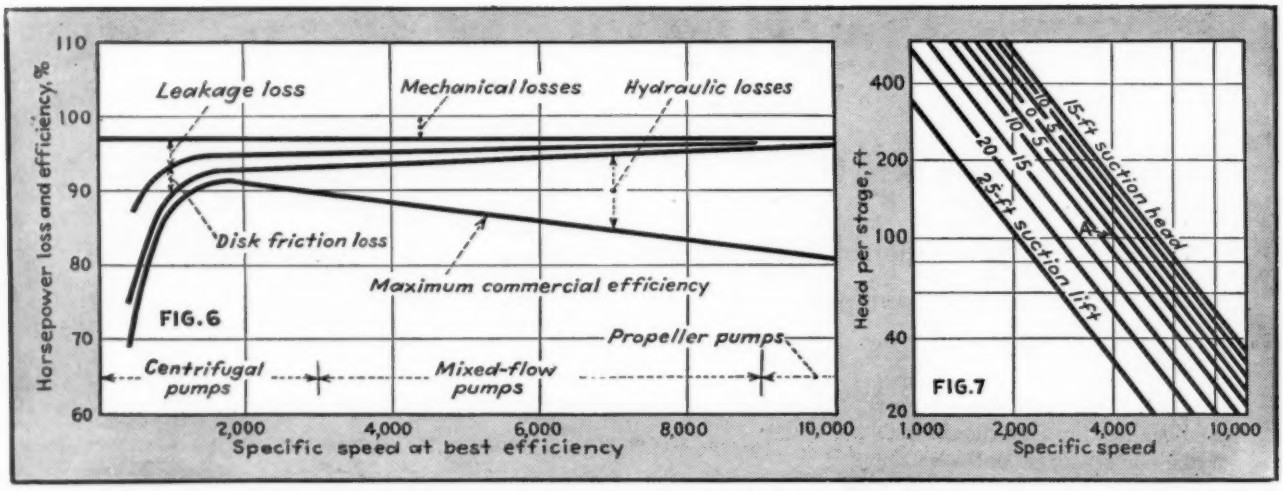


Fig. 6—Approximate distribution of losses and percent of efficiency for pumps with different specific speeds

Fig. 7—Maximum specific speeds that are recommended for given suction lifts and for given discharge heads

pump was designed, corresponding to its gpm capacity.

When the three quantities, speed, capacity and head, are selected the hydraulic design of a centrifugal pump is practically fixed within limits. All impellers with the same specific speed resemble each other in proportions. On the other hand, for a given head and capacity, the specific speed, and consequently the impeller type, can be selected to some extent arbitrarily by changing impeller speed.

For example, Fig. 5 shows five impellers, representing the useful specific-speed range—all designed for the same conditions but operating at different speeds. Results are startling. Beginning with impeller *A* on the left, with $N_s = 932$, the impeller diameter can be reduced by one half if speed is doubled, as indicated by impeller *B*. Further speed increase results in a still smaller impeller until we come to *E*, with $N_s = 12{,}600$, which has an effective diameter of only 1/7 of *A*, and the speed has been increased nearly eleven times. Change of size is also reflected in size of the pump's casing.

Fig. 1 to 4 show examples of variation in impeller forms due to a change in specific speed. These photos help to give a clearer picture of the cross-sections, Fig. 5. Fig. 1 is a low-specific-speed impeller corresponding to cross-section *A*, Fig. 5. The centrifugal impeller, Fig. 2, has a medium specific speed similar to cross-section *B*, Fig. 5. Fig. 3 shows the form of a medium-specific-speed mixed-flow impeller on the order of cross-section *C*. The impeller, Fig. 4, is a high-specific-speed propeller type (axial-flow) of a design like cross-section *E*.

Since the impellers are so different in appearance, their operating characteristics must also be different. The pump designer's problem then is to select the specific speed for an intended job that satisfies the requirements as far as design limitations permit.

One of the most important effects of specific speed is the maximum efficiency attainable, particularly in the low-specific-speed range. Because of the inherent characteristics of impellers of different specific speeds certain losses are

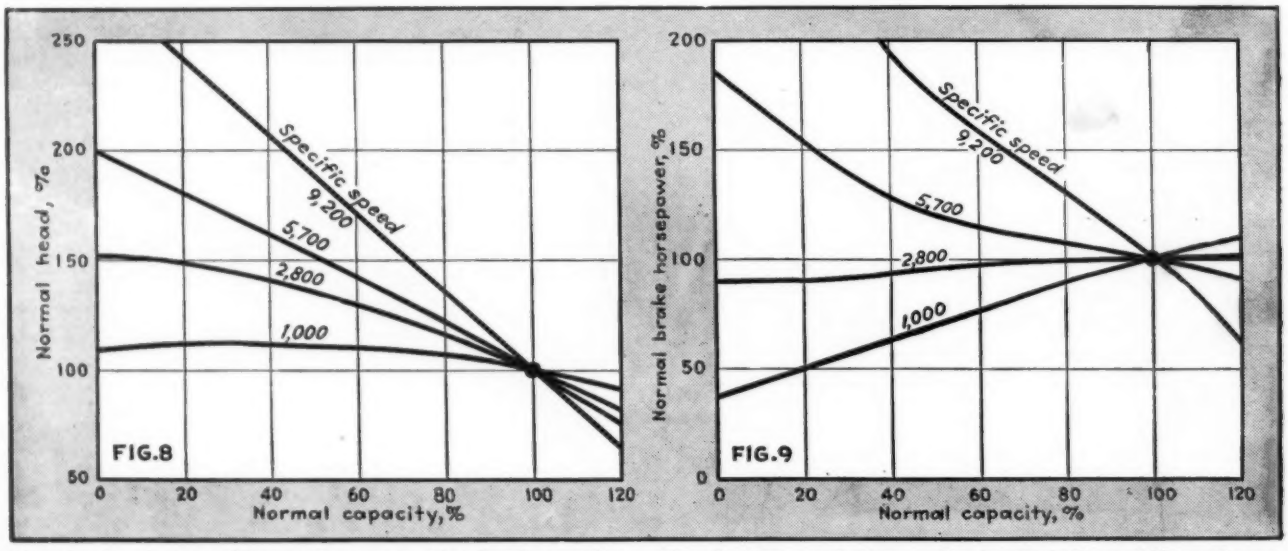


Fig. 8—On low-specific-speed pumps the head remains fairly constant from rated capacity to shutoff whereas the head of high-specific-speed pumps rises sharply

Fig. 9—From rated capacity to shutoff conditions, horsepower of low-specific-speed pumps decreases whereas the horsepower of high-specific-speed pumps increases rapidly

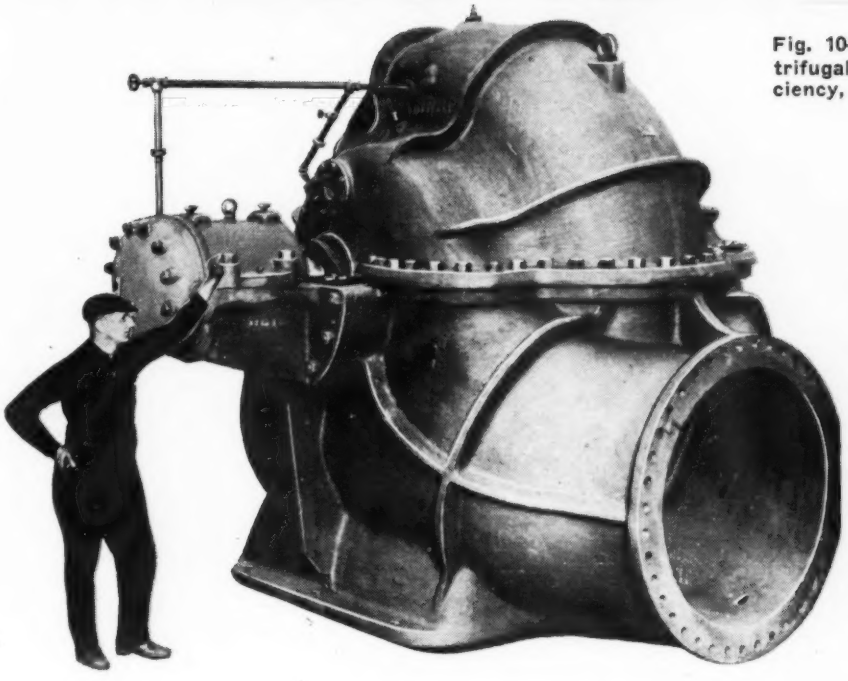


Fig. 10—Double-suction low-specific-speed centrifugal pump rated 50,000 gpm at 85% efficiency, used for condenser circulating water

greater in one than in another. One of these losses, disk friction (the resistance of the liquid between casing walls and the shrouds) tends to oppose the impeller's rotation. Fig. 6 shows how disk friction of the exposed shroud area increases greatly at the lower specific speeds.

Leakage through the pump's wearing rings is another important loss. Here again low-specific-speed impellers are penalized because of their larger eye and resultant larger wearing-ring diameter. Since the leakage area is directly proportional to diameter, assuming equal clearance, leakage loss increases as the ring's diameter. Mechanical losses from bearing and packing friction are practically constant for all types of impellers, irrespective of their specific speed.

HYDRAULIC LOSSES

The fourth important loss is hydraulic, and is due to flow through the impeller. Since all impellers shown in Fig. 5 have equal capacity, average velocities are roughly proportional to the inlet area. This area, however, decreases for the higher-specific-speed impellers; therefore, even though they have less exposed vane surface, the faster flow produces greater hydraulic losses.

By combining the four major losses, as in Fig. 6, they are at a minimum at a specific speed of about 2000; consequently maximum efficiency is obtained in this zone, for the comparison made with impellers of equal water horsepower. At lower specific speeds, efficiency drops sharply because of leakage and disk friction. Specific speeds lower than 500 are rarely used. At higher specific speeds, drop in efficiency is more gradual for the increase in hydraulic losses is partly offset by a reduction in other losses.

From the curves in Fig. 6, the question might be asked: If efficiency is highest at a specific speed of 2,000, why not make all impellers of that type? This is impossible and not necessarily desirable. Pumping conditions for a given application are fixed by required head and capacity. If specific speed is low it can be increased only by speeding up the pump's driver. But speed ranges commercially available are limited so even with the highest-speed driver, specific speed can still be low for certain conditions, such as boiler-feed service. Dividing the head among several stages in series is a common solution to this problem. This reduces the head per impeller so that a more favorable head-and-capacity ratio is obtained.

At this point, an economic balance has to be considered. By using enough stages the pump can be given a peak efficiency. Fewer stages, however, reduce pump cost because of a reduction in the number of parts, even though larger impellers are required, but at a loss in efficiency. As with most problems, final pump design is a compromise that balances over-all length, costs and performance.

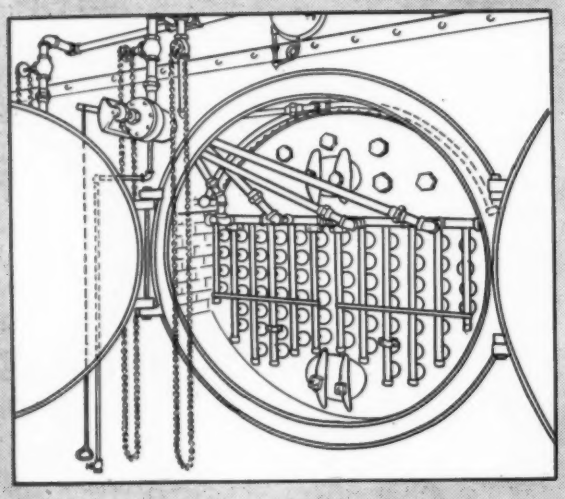
If pumping conditions favor a specific speed higher than 2000, use as high a driver speed as possible because efficiency drops only slightly, as indicated in Fig. 6, and pump's over-all size is reduced. This reduction is reflected in the pump's total cost.

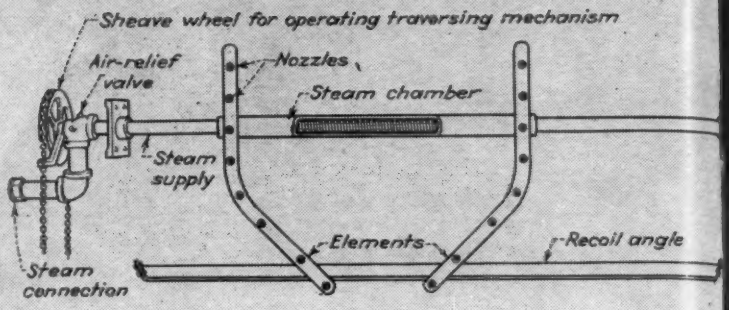
Available suction head may determine maximum speed and consequently specific speed that may be used. As previously mentioned, the average velocities in a high-specific-speed impeller are higher than in one of lower specific speed. As a result a greater suction head is required to maintain the pump primed as the speed increases even though pumped head remains the same. Fig. 7 gives average suction head required for normal pumps, as given by the *Hydraulic Institute Standards*. For instance, if the pumped head is 100 ft and there is a 5-ft suction lift, the highest specific speed recommended is 4000, point *A*.

Specially designed impellers will operate with a greater suction lift than that in Fig. 7, but at the expense of efficiency. With a single-stage pump, this reduction in efficiency shows up in the pump's over-all performance. In a multistage pump, however, it is necessary to have only the first stage of spe-

(*Continued on page* 146)

Fig. 11—Vertical mixed-flow high-specific-speed 70,000-gpm pump develops 85% efficiency. Pump is that portion below flange at the man's head





1 Fixed-position soot-blower assembly (at left) operates through a ratchet to direct steam or compressed air to one of two groups of vertical pipes aligned before boiler tubes

2 Above assembly of two fixed, nozzle-equipped pipes travels by worm action across the face of the boiler-tube sheet to direct the steam-blowing jet into tubes of an hrt boiler unit

SOOT REMOVAL: An Operating Must

In his second article, Assistant Editor McCabe describes hand-operated soot blowers for firetube boilers. Watertube types—automatic, retractable and mass-flow—will be covered later

► AN EFFECTIVE SOOT-REMOVAL action comes from permanently fixed or built-in assemblies serving in the role of integral, helpful tools for good operation. These built-in assemblies are true soot blowers. They range from the fixed nozzle-and-pipe design for firetube boilers up to the large mass-flow, completely automatic installations now highlighting modern practice.

The fixed-position blower, widely used in firetube boilers, appears in Fig. 1. This particular application has a 4-position ratchet that permits routing steam or compressed air from a master valve to one of two groups of four vertical pipes, aligned before the tubes of an hrt boiler. Each vertical pipe in the different groups carries a series of nozzles each of which fronts into an individual tube of the boiler. Direction of steam or air discharge from the nozzle is against or counter to the stack draft.

A Traveling Assembly. Fig. 2 illustrates an assembly, mounted at the front end of an hrt boiler, which consists of two fixed elements in which are placed steam jet nozzles so located that each passes the center line of the horizontal rows of tubes in the boiler-tube section. This assembly is moved across the tube sheet by a chain wheel and worm mechanism. Steam supply reaches each element through a common feeder pipe, which also houses the worm.

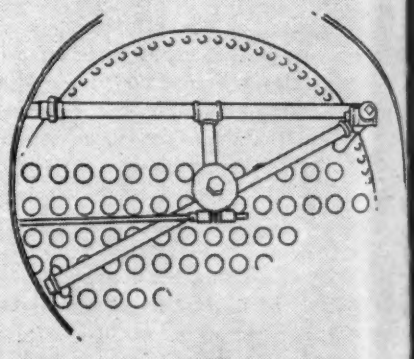
Another system, employing a worm for moving the fixed blower assembly across the face of the tube sheet of an hrt or Scotch marine boiler, is shown in Fig. 3. Steam or compressed air passes through a series of rotating joints to enter a vertical pipe from which are bled the small branch lines discharging through nozzles at their ends into the boiler tubes.

A variation of this practice of moving the nozzle-equipped pipe has been used for reaching the lower tubes of economic and similar firetube boilers. This variation employs a device that lifts the entire steam-piping assembly—supply members and the discharge element, a horizontal, nozzle-equipped pipe. This lift carries the assembly across the tube sheet from bottom to top.

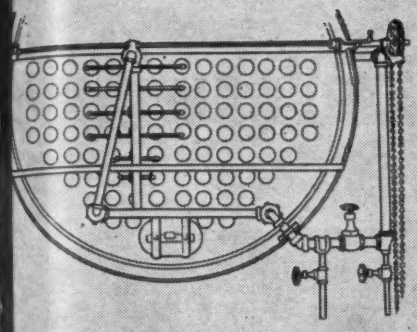
ROTARY SOOT BLOWERS

Firetube boilers, principally hrt, also have a rotary form of soot blower. In Fig. 4 a single, nozzle-equipped pipe operates through a rotary joint. Rotation of this member comes about by a chain-operated wheel, moving a worm that in turn revolves or rotates the pipe through a swivel. Steam or air at 40 to 100 psi blows from the discharge pipe through its nozzles directly into the boiler tubes.

A second rotary or swinging-arm soot blower for firetube service appears in Fig. 5. This design employs an externally mounted operating head that connects to a swinging pipe arm. This arm contains nozzles along its length to per-



4 A chain-operated wheel moves a worm and swivel to rotate the nozzle-equipped blowing element that sweeps the tube sheet area



3 Steam jet blows from the discharge nozzles mounted on the end of each branch line

mit blowing steam into the boiler tubes. Movement of this swinging arm is produced by a lever or a wheel attached to the operating swivel head. A lever limits the arc of the swinging arm to about one third of a revolution. For larger arcs a wheel and sprocket are used.

Other Firetube Boilers. For large-capacity hrt boilers, where many tubes are used, and for Scotch marine and economic-type units, some manufacturers recommend a double or duplex piping system employing either a lever or chain - and - sprocket - operated swivel head. Such a system, Fig. 6, has a swinging arm that travels through a much smaller arc than does a single rotating member. Some advantage may be claimed from better nozzle alignment.

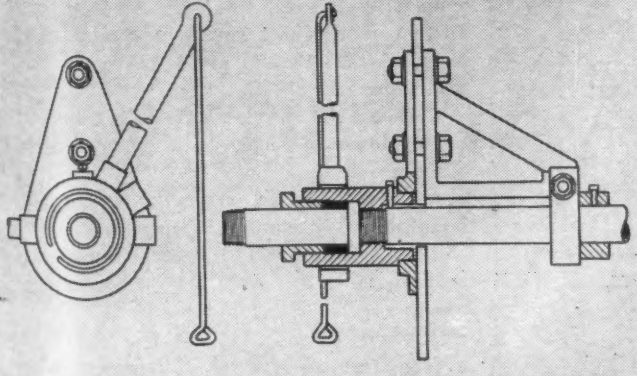
One method of rotary soot blowing, in which the nozzle itself is rotated, has been used with brick-setting hrt boilers, Fig. 7. This multiported-blower assembly employs a single jet blow but it has different-angled steam ports, only one of which is in use at a given time. The entire nozzle head rotates about its axis to allow each port, when open, to direct a jet of steam against a ring or circle of tubes in the tube sheet. This ringed portion depends upon the angle of the port opening. One port discharges into the center group of tubes in the tube sheet. Remaining ports open at progressively greater angles so that the outside or greatest-angled nozzle directs steam toward the end of the most distant tube rows, those at the outermost ring.

A rotating valve disk with a single 1-in. opening admits steam to the blowing nozzle. This valve disk is operated by a handwheel mounted over a valve-rod sleeve, which extends through the blower-operating head to the rotating disk. Selection of the particular port through which the steam will discharge can be made by moving a trigger arm, in front of the handwheel, which rotates the valve rod to the desired position. Once a selection has been made, the handwheel is moved slowly to complete one revolution in about a half minute. Then the trigger arm is moved to select another port, and the operation is repeated.

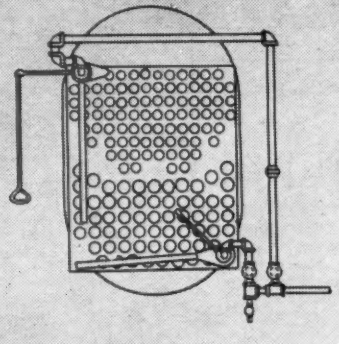
This assembly mounts on the rear wall of the combustion chamber with the nozzle setting in a pocket formed by the boiler brickwork and the high temperature-resistant cast-iron frame of the blower itself. This pocket protects the nozzle from direct contact with the hot furnace gas. Soot-blowing action from this end is in the same direction as the stack draft.

Blower Operation. All the foregoing blowers are firetube-boiler installations, operated by hand, where soot removal has been either with or against the stack draft. There are different opinions advanced on the operating merits gained from discharging the blowing steam jet in the same direction as the stack draft. Those who claim advantages feel that all dislodged soot has a greater chance to be swept out the stack by a parallel blow as contrasted to a counter blow. One practical advantage put to use in front-end counter-draft hrt soot-removal installations is the temperature difference between opposite ends of the boiler drum. At the front end, the heat is usually not intense enough to require a high temperature-resistant metal. This permits the use of standard piping, which may prove less expensive or possibly allow a heavier construction, one capable of handling a higher-pressure steam with its resulting benefits.

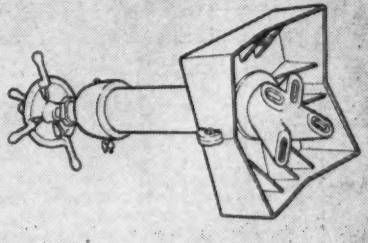
The higher-pressure steam gives two operating advantages: (1) It delivers a steam likely to remain dry during its passage through the boiler tubes and out the stack. (2) Combined with a properly designed discharge nozzle it gives an effective blowing action along the tube surface. Importance of dry steam for blowing action is, of course, apparent since condensation within a boiler tube would tend to accelerate the accumulation of soot and flyash on the surface. Use of compressed air free of moisture would avoid this difficulty.



5 An externally mounted operating head connects to a swinging pipe arm through a swivel. A lever or wheel moves assembly—lever limits arc to 1/3 of a revolution



6 Duplex or double-piping setup enables blowing large tube-sheet areas with small arc sweeps of blower pipes



7 Single-opening valve disk admits steam to selected disk of a group. Ports in group open at progressively greater angles to cover tube sheet

Steam-Jet Air Evacuators Make Vacuum

Besides the many duties that steam-jet air ejectors perform around a power plant during normal operation they give important service in getting generating equipment ready to run from a shutdown condition. Simple construction means economy

By PHILIP FRENEAU
Process Engineering Div.
Elliott Company

► ALL POWER PLANTS have the problem of establishing a vacuum to start the system in operation. Main condenser must be freed of air to permit steam condensation. If the circulating-water system uses a siphon arrangement it also must be purged of air to establish proper water flow, and reduce the initial head on the circulating-water pump. Steam-jet air ejectors are almost universally used for the first purpose, and are frequently applied for the second.

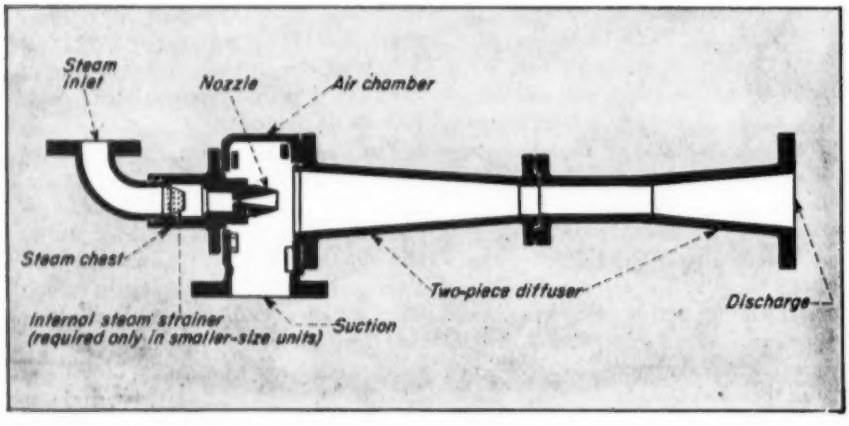


Fig. 1—A steam-jet evacuator has the same features as an ordinary steam-jet air ejector, but is built for high capacity; both perform at same efficiency

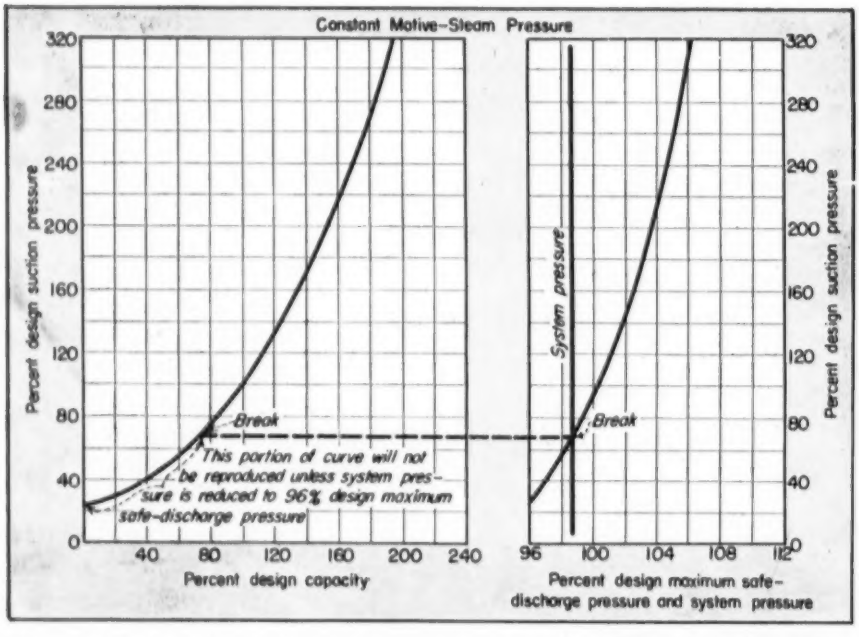


Fig. 2—Typical air-ejector performance curve with constant motive-steam pressure shows stable range, break point for suction and discharge pressure

In previous articles (POWER, July 1945, pp 77-9, and Feb 1946, pp 75-8) steam-jet evacuators were briefly mentioned. We'll now cover this type of equipment in more detail.

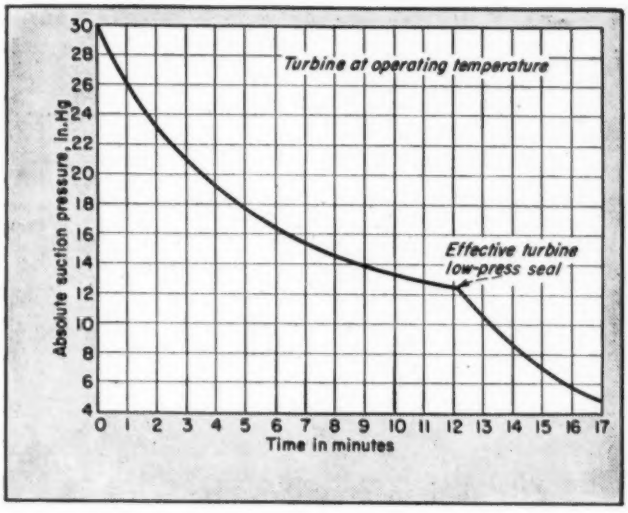
A steam-jet evacuator is an ordinary single-stage steam-jet air ejector designed for high capacity. In its early days it was less efficient than the common ejector, but recently more attention has been paid to its design and it is now more on a par with the other units. Fig. 1 shows a typical unit very similar to its smaller brother, the normal running or vacuum-maintaining ejector. Because of the evacuator's larger size, the diffuser is frequently made in two pieces for easier machining. For best operation, the same care in machining and assembly must be employed as for the standard unit type of air ejector.

The evacuator is frequently designed for a lower steam pressure than the running unit to start pumping down the vacuum system before normal plant steam pressure is established.

The evacuator's characteristic curve determines the unit's performance. Fig. 2 illustrates a typical plot, the right-hand chart shows the maximum discharge pressure against which the unit can operate without breaking, and the left-hand chart the capacity vs absolute suction-pressure relationship for stable operation. If the actual discharge pressure is at all times less than the maximum safe discharge value, the left-hand section of the chart can be used to determine the time-pressure curve of evacuation.

Consider the simplest case of a constant-volume air-leakage-free and moisture-free system. Let's find the time required to pump the system down from atmospheric pressure to a given lower absolute pressure using an ejector whose characteristics are given, as for example in Fig. 2. Ejector capacity is almost always given in lb per hr; in other words, a rate of removal. The ejector plot in the left chart of Fig. 2 is, therefore, absolute pressure vs *rate of pumping*. Weight of air in a system is easy

During Power-Plant Starting Periods



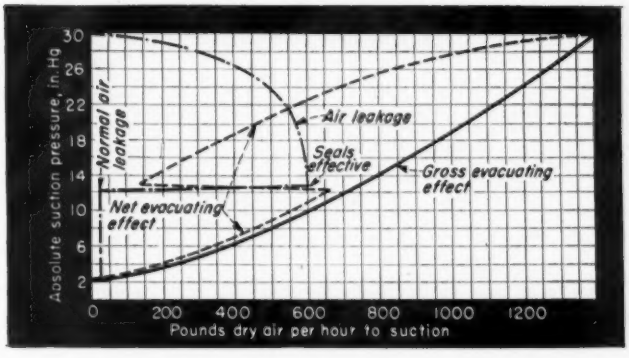


Fig. 3, above—Besides pumping air out of condenser during starting the evacuator must also remove air leaking in past shaft seals; ample capacity must be provided to do job. Fig. 4, left—Time taken to reduce condenser pressure to given values for 1750 cu ft, based on Fig. 3

to determine from a derivation of the universal gas law:

$$W = \frac{1.33pV}{460 + t} \qquad (1)$$

where

p = system pressure, in. Hg abs
V = system volume, cu ft
W = weight of air in system, lb
t = system temperature, F

If the system temperature is very close to constant, true for most power-plant work, the air weight in the system is a direct function of pressure and the weight removed when reducing pressure from p_1 to p_2:

$$W_1 - W_2 = \frac{W_1 (p_1 - p_2)}{p_1} \qquad (2)$$

It is possible to set up an equation for the left-hand curve of Fig. 2 as:

$$p = a + b\,(W/\text{hr})^n \qquad (3)$$

Evacuation time can be found by using equations (2) and (3), but the latter will apply only to a given machine. This will not prove a general solution for all ejectors.

Air leakage reduces the evacuating effect of the ejector. Fig. 3 shows a typical example of air-leakage reduction in evacuating capacity. Maximum safe discharge pressure is not shown as the actual system pressure is less than the maximum value. The solid curve is the familiar suction pressure vs capacity plot, and represents the gross evacuating effect of the machine. The dot-dash curve on the left represents air leakage, being zero at the start of the process and building up to a maximum as the pressure differential approaches the critical of 15.9 in. Hg abs. (For dry air, critical pressure is 53% of the initial, or $0.53 \times 30 = 15.9$.)

At about 13 in. Hg abs it is possible to speed the turbine sufficiently to make the low-pressure seals effective, and the leakage drops to its nominal running value. Part of the gross ejector capacity handles this leakage and only the excess above this flow is available for evacuation needs. The dotted curve

Table I—Increment Calculation Of Pressure-Time Characteristic

Net evacuating effect from Fig. 3

Air temperature = 92F System volume = 1750 cu ft

(1) Pressure at suction, in. Hg	(2) Average pressure per step, in. Hg	(3) Pounds of air removed*	(4) Corresponding lb of mixture**	(5) Ejector capacity, lb per hr	(6) Ejector capacity, lb per min	(7) Time per step, minutes	(8) Elapsed time, minutes
30							0.000
	29.0	8.4	8.70	1190	19.8	0.440	
28							0.440
	27.0	8.4	8.71	930	15.5	0.562	
26							1.002
	25.0	8.4	8.73	760	12.65	0.690	
24							1.692
	23.0	8.4	8.76	640	10.68	0.830	
22							2.522
	21.0	8.4	8.80	520	8.66	1.015	
20							3.537
	19.0	8.4	8.84	430	7.17	1.232	
18							4.769
	17.0	8.4	8.90	320	5.33	1.670	
16							6.439
	15.0	8.4	8.98	230	3.83	2.341	
14							8.780
	13.0	8.4	9.04	150	2.50	3.616	
12							12.396
	11.0	8.4	9.15	600	10.00	0.915	
10							13.311
	9.5	4.2	4.69	530	8.83	0.531	
9							13.842
	8.5	4.2	4.76	480	8.00	0.596	
8							14.438
	7.5	4.2	4.85	420	7.00	0.694	
7							15.132
	6.5	4.2	4.98	370	6.17	0.808	
6							15.940
	5.5	4.2	5.18	300	5.00	1.036	
5							16.976
Total.		105.0	113.07			16.976	

* From equation (2) ** From equation (4)

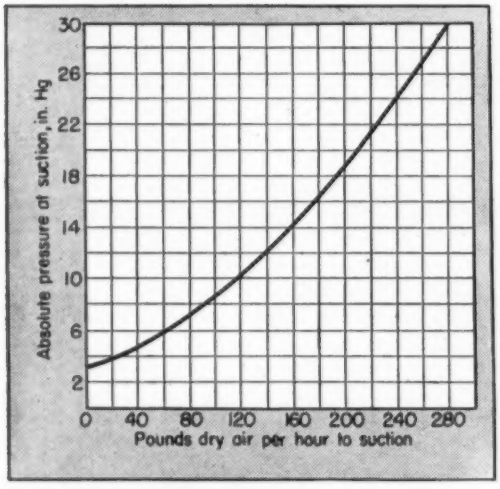


Fig. 5—Example of evacuator characteristic for priming cooling-water piping system

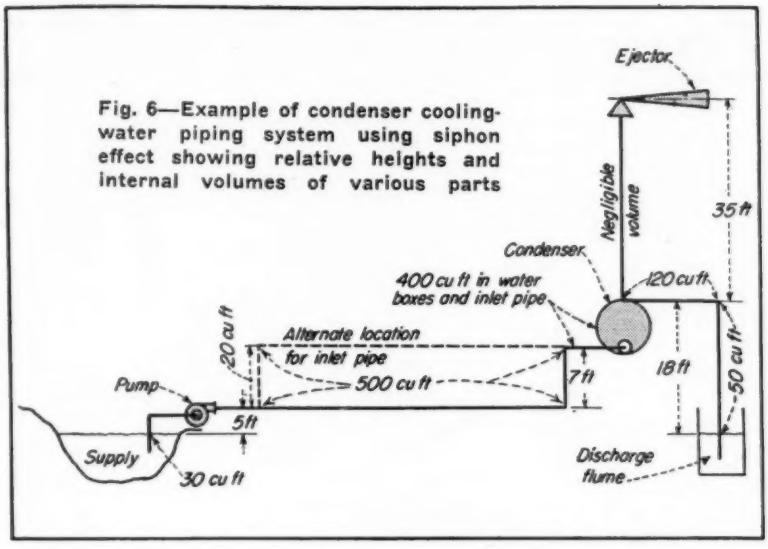


Fig. 6—Example of condenser cooling-water piping system using siphon effect showing relative heights and internal volumes of various parts

shows the net evacuating effect, which equals the gross-capacity curve less the air-leakage curve at any given pressure.

Note that it is possible with very high low-pressure-seal leakage to have the net evacuating effect zero at some relatively high pressure. In such a case no improvement in vacuum is obtainable unless the turbine is speeded up to make the seals effective. Because of high temperature this can be a dangerous procedure and the evacuator should be large enough to show positive values on the net evacuating curve.

The following example illustrates the effect of leakage and vapor on evacuation and a procedure of figuring evacuating time, Table I. Assume the leakage and the net and gross capacities as shown in Fig. 3, and the total system volume to be 1750 cu ft. Water circulates through the condenser tubes at 70 F, and just sufficient steam flows to turn the turbine over at 60 to 600 rpm. With this small amount of steam and 70-F water, the vapor temperature leaving the condenser is not more than 92 F. The resulting partial vapor pressure, $P_v = 1.50$ in. Hg abs.

Usually, it is easier to solve the problem using tabular differentiation. Small pressure intervals are assumed, say 1 in. Hg steps, and the resulting weight for each step determined by equation (2). Then rate of air removal comes from the characteristic curve for the average pressure of the interval. For example, in a step from 12 to 11 in. Hg abs the capacity is found at 11.5 in. Hg abs. Dividing the weight removed per interval, by the average rate from the curve, gives the time for the pressure step. Summation of the times gives the total evacuating time.

Actual power-plant problems are not so simple as the solution just indicated. For a condenser, the problem is complicated by the presence of water vapor and air leakage. When priming a circulating-water system, air leakage and water vapor slightly complicate the problem, but the major complication arises from change in system volume.

Let's consider first the effect of water vapor. Water in the system exerts a partial pressure corresponding to its temperature and adds a certain weight of vapor to the air in accordance with Dalton's law (see POWER, May 1945, p 134, and Feb 1946, p 75). Weights of air determined from equation (2) must be increased by the vapor component in accordance with the derivation of Dalton's law:

$$W_m = (W_1 - W_2)\left(1 + \frac{0.62P_v}{P_t - P_v}\right) \quad (4)$$

where:

W_m = air-vapor mixture removed per interval
P_v = vapor partial pressure corresponding to water temperature
P_t = system average pressure for interval $= p_2 + (p_1 - p_2)/2$
$(W_1 - W_2)$ = weight of air removed in reducing pressure from p_1 to p_2

The initial weight of air in the system from equation (1) is:

$$W = \frac{1.33\,pV}{460 + t} = \frac{1.33 \times 30 \times 1750}{460 + 92} = 126 \text{ lb}$$

Weight of air removed in reducing pressure through the assumed intervals

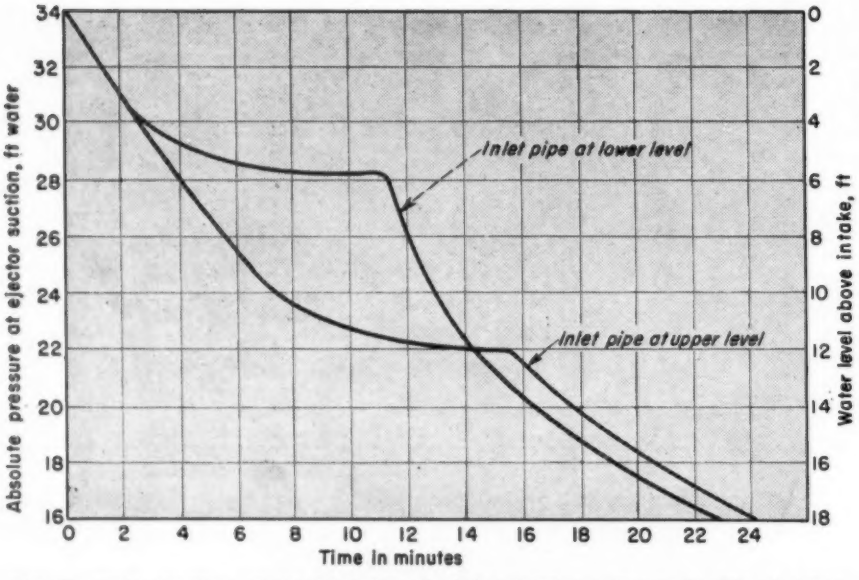


Fig. 7—Pressure-time characteristics of piping systems shown in Fig. 6 when primed with evacuator operating on curve shown in Fig. 5; figured in Table II

will be found by equation (2) and the added effect of water vapor by equation (4) in the preceding column.

In Table I note that water vapor adds 8.07 lb to the weight of air removed and this additional weight is added mainly toward the end of evacuation where ejector capacity is the least. Also note that the summation of column (3) checks weight from equation (2):

$$W_1 - W_2 = W_1 (p_1 - p_2)/p_1 = 126(30-5)/30 = 105 \text{ lb}$$

Plotting column (1) against column (8), as in Fig. 4, gives the *expected* evacuating-time curve. By plotting *actual* pressure-time results on the same sheet the system can be roughly analyzed. For example, if the upper section of the actual curve departs from Fig. 3 but the lower section parallels it, the actual gland leakage is different from the assumed value. If the curves are not parallel it shows the water-vapor component is other than assumed, the system volume is different or the ejector capacity has been reduced. This last can be caused by deposits building up on the diffuser, reducing its area.

If the actual curve becomes parallel to the time axis, the ejector is probably breaking and either the steam nozzle is clogged, or the motive steam conditions are not correct. Of course, at low absolute pressures a point in evacuation will be reached where the ejector capacity is just sufficient for the in-leakage, and the curve would be parallel to the time axis at this point. Normally the evacuator is shut off long before this point is reached and the running ejector takes over. The running ejector should be started as soon as the condensate supply from the main condenser to the ejector condensers is sufficient to permit operation.

The pressure-time curve for an ejector priming a water system is calculated in a similar manner, but the weight of air removed is more difficult to determine. Fig. 6 shows a schematic layout of a siphon system, and Fig. 5 the characteristic of an evacuator. Two inlet water lines are shown, each having the same volume, but one with the horizontal run 5 ft above water level and the other 12 ft above. For each, the circulating pump is at water level.

Once the siphon action is established either setup offers the same resistance to flow, that is, requires the same pumping horsepower, but the starting characteristics are appreciably different, even though the ejector has the same high location in each case. By operating the ejector and reducing the pressure in the system the initial discharge head on the pump is lowered and a smaller motor may be used, thereby reducing first cost.

Table II shows the computations; the water vapor in either case is negligible with a partial pressure of 0.6 in. Hg abs. If the siphon lift were greater, requiring the evacuator to maintain a lower absolute pressure, this factor would have to be considered. Note in the table and Fig. 7 that the higher horizontal run needs a 5.5% longer time for evacuation than the lower run.

Table II—Calculation of Pressure-Time Characteristic for Priming Cooling-Water System

(See Fig. 5 and 6) Water temperature = 65 F

(1) System absolute pressure, ft water	(2) System absolute pressure, in. Hg	(3) Air in system, cu ft	(4) Air in system, lb*	(5) Air removed per step, lb	(6) Ejector capacity lb per hr	(7) Ejector capacity lb per min	(8) Average pressure per step in. Hg	(9) Time per step, min	(10) Elapsed time, min
With condenser inlet pipe in lower position									
34	30.0	1120	85.0						0.00
				6.0	275	4.59	29.1	1.31	
32	28.2	1109	79.0						1.31
				5.4	264	4.40	27.3	1.23	
30	26.5	1098	73.6						2.54
				36.6	250	4.17	25.6	8.78	
28	24.7	592	37.0						11.32
				3.3	235	3.92	23.8	0.84	
26	22.9	581	33.7						12.16
				3.1	225	3.75	22.0	0.83	
24	21.2	570	30.6						12.99
				4.6	210	3.50	20.3	1.31	
22	19.4	530	26.0						14.30
				8.5	197	3.28	18.5	2.59	
20	17.7	390	17.5						16.89
				7.5	185	3.08	16.8	2.43	
18	15.9	250	10.0						19.32
				10.0	167	2.78	15.0	3.60	
16	14.1	0	0						22.92
Total				85.0				22.92	
With condenser inlet pipe in upper position									
34	30.0	1120	85.0						0.00
				6.0	275	4.59	29.1	1.31	
32	28.2	1109	79.0						1.31
				5.4	264	4.40	27.3	1.23	
30	26.5	1098	73.6						2.54
				7.5	250	4.17	25.6	1.80	
28	24.7	1057	66.1						4.34
				5.5	235	3.92	23.8	1.40	
26	22.9	1046	60.6						5.74
				5.1	225	3.75	22.0	1.36	
24	21.2	1035	55.5						7.10
				29.5	210	3.50	20.3	8.43	
22	19.4	530	26.0						15.53
				8.5	197	3.28	18.5	2.59	
20	17.7	390	17.5						18.12
				7.5	185	3.08	16.8	2.43	
18	15.9	250	10.0						20.55
				10.0	167	2.78	15.0	3.60	
16	14.1	0							24.15
				85.0				24.15	

* From equation (1)

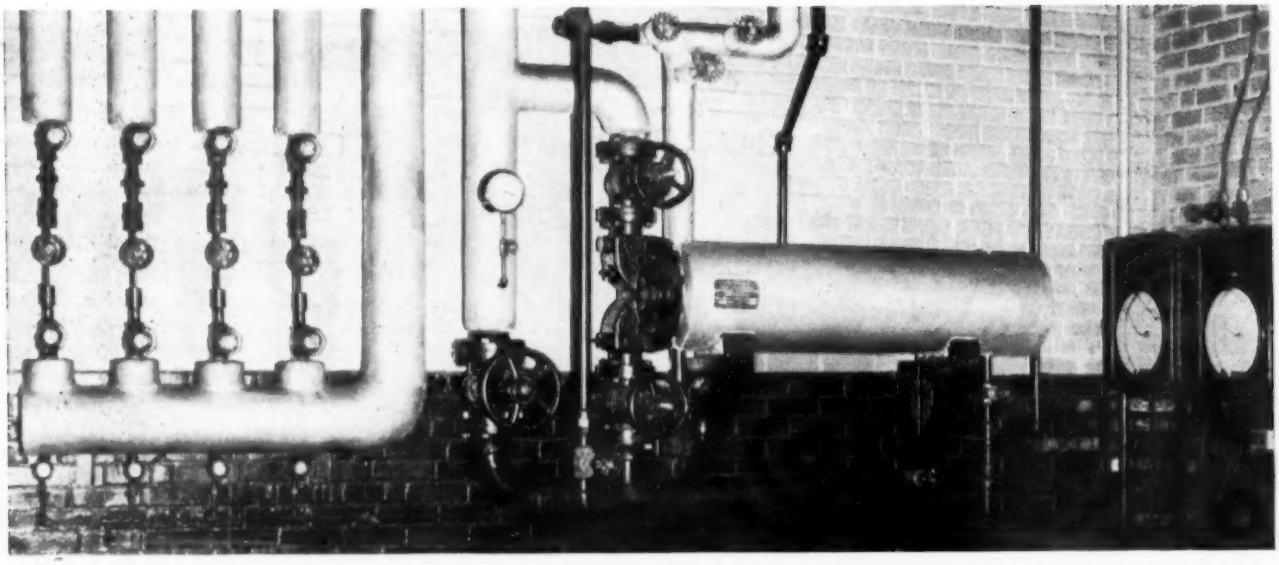
PLACING AIR EVACUATOR

Once the siphon is established, the evacuator suction valve must be closed using an absolutely tight valve, usually water or steam sealed, though sometimes the ejector operates continuously to prevent air pockets forming. In such cases it is well to locate the unit 34 ft above the condenser to prevent water carryover. In the example, this would place the ejector 52 ft above the water supply or considerably more than the 34-ft-water barometer height. The circulating-water pump, however, adds some pressure to the water, and this extra height tends to compensate.

Table II demonstrates the rather involved calculations needed when the system air volume changes. The example chosen shows that for a very minor change in piping setup an appreciable time saving is made in evacuating the water system. With a higher siphon, the importance of running the horizontal line at as low a level as possible would be accentuated.

Both Fig. 3 and 5 do not have the backpressure curves shown on them. Remember, however, that backpressure must be considered to be sure that the ejector is not operating in the break. As evacuators generally discharge to atmosphere through a muffler, the problem of backpressure is relatively minor.

Boiler Blowdown, Like a Hole in Your Pocket, Can Waste Income



For economy, continuous-blowdown water can flow through shell-and-tube exchanger where it gives heat to feedwater

Why waste heat by specifying a high rate of blowdown without checking the facts? asks N T Pef. Amount may be much higher than needed to produce clean steam and minimize scale, corrosion, embrittlement

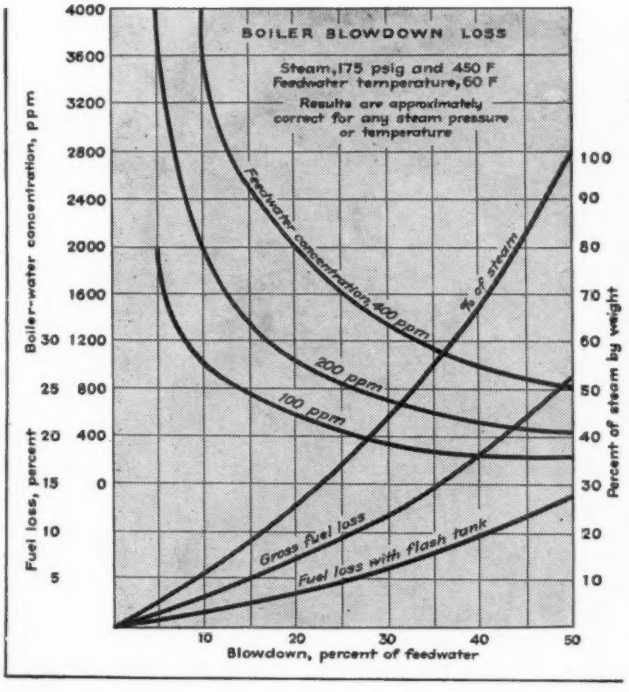
► BOILER BLOWDOWN, whether continuous or manual, serves only one purpose: to regulate the amount of total solids (concentration) contained in boiler water. How much to blow down depends on reaching a safe medium between gains and losses.

Gains are definite savings in heat when blowdown can be reduced. Losses, on the other hand, often cannot be estimated when they are introduced by specifying the amount of blowdown haphazardly. So the best procedure is to eliminate all negative factors. Detrimental effects of holding too high a concentration usually show up first as dirty steam, which coats turbine blades and heating coils, and lowers their capacity and efficiency. In one instance, dirty steam made pipeline valves inoperative a few months after the plant started to operate. High concentration also increases the chance of scale formation in the boiler and advances other detrimental conditions like embrittlement and corrosion. Because such losses cannot be evaluated, best plan is to eliminate them completely.

Expressing Total Solids. Fundamentally, concentration means total solids, but they can be expressed in other terms, such as *P*, phenolphthalein, or *M*, methyl-orange alkalinity, chlorides or conductivity. Important step is to decide which test to follow in maintaining the concentration best suited to the plant. In the absence of other controlling factors, commonest way to set the high limit of boiler concentration is to use steam purity as a basis. So long as the steam tests pure, boiler concentration is increased until priming or foaming lowers the purity of the steam. Whenever the total-solids carryover remains less than 5 ppm, the steam is considered clean and blowdown is set to maintain that condition.

Although a conductivity meter may be used, I find the *P* alkalinity test a simple and inexpensive way to determine steam purity. In a sample of condensed steam place one drop of phenolphthalein. If the color does not change to pink consider the steam pure. Although this test probably will not show contamination of less than 5 ppm, steam does not foul prime movers and heating equipment if the condensate is negative to the *P* indicator.

Heat Loss. Considering blowdown in relation to fuel loss, Fig. 1 shows that (1) with a blowdown of 10%, fuel loss is 3% with no heat exchanger and 1.5% with flash-tank heat recovery and (2) with 200-ppm feedwater concentration, the boiler water contains 2000 ppm. Assume the steam is perfectly clean and there is no reason to believe that concentration can be increased without impairing steam quality. Question is, Should we increase the concentration or not? My answer is, No; there is little to gain in reducing the blowdown because total loss is now less than 3%. One percent is probably the most that can be saved, and this amount does not justify taking any risks on boiler scale or other adverse conditions. On the


BOILER BLOWDOWN LOSS
Steam, 175 psig and 450 F
Feedwater temperature, 60 F
Results are approximately correct for any steam pressure or temperature
Boiler-water concentration, ppm
Fuel loss, percent
Percent of steam by weight
Feedwater concentration, 400 ppm
200 ppm
100 ppm
% of steam
Gross fuel loss
Fuel loss with flash tank
Blowdown, percent of feedwater

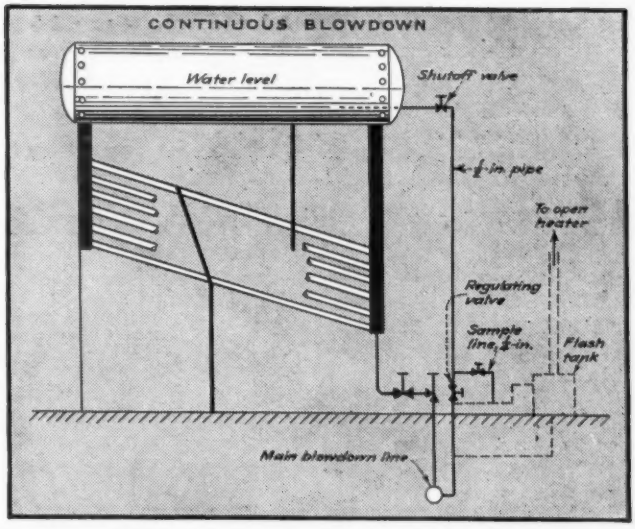


Fig. 1 (left)—The percent-steam curve shows loss in output. If the blowdown is 30%, leaving 70% of the feedwater for steam production, the steam loss is 30 ÷ 70 = 43%

Fig. 2—A simple continuous-blowdown arrangement consists of a discharge line from the drum to the blowdown drain. The dotted line shows connection to a flash tank

other hand, if present blowdown is 20%, reduction is advisable, assuming that the steam purity is satisfactory and will probably remain so under higher concentration. Reason is that the blowdown heat loss at this point is appreciable and greater savings are possible.

In deciding what concentration to carry it is of considerable help to learn how other plants operate. A good average for plants using 100% makeup water is 2500 ppm total solids, with 3400 ppm high and 1500 ppm low limit. For a condensing plant using a negligible amount of makeup, 500 ppm of total solids should be a good average. After determining the concentration to hold, next step is to set up a procedure for maintaining this value, and decide whether to use continuous or intermittent hand blowdown.

Type of Blowdown. There is no doubt about it, continuous blowdown should be used even in the smallest plant because installation cost is negligible. The simplest form, Fig. 2, consists of a ½-in. line from the drum discharging into the main blowoff line beyond the blowdown valves. Its entire cost for a 500-hp boiler is the price of two ½-in. valves and one or two lengths of ½-in. pipe. Dotted lines show a flash tank, which recovers about half of the heat wasted; its installation is justified because the cost is small compared to the savings made. A closed heat exchanger can also be used.

Where chemical tests serve as a guide in regulating boiler blowdown, the *P* alkalinity gives more satisfactory results because the endpoint is easiest to determine; even the most inexperienced operator cannot fail to note when the pink color disappears. Endpoint of the *M* alkalinity test is not as distinct, so it takes a careful eye to note the color change when it takes place.

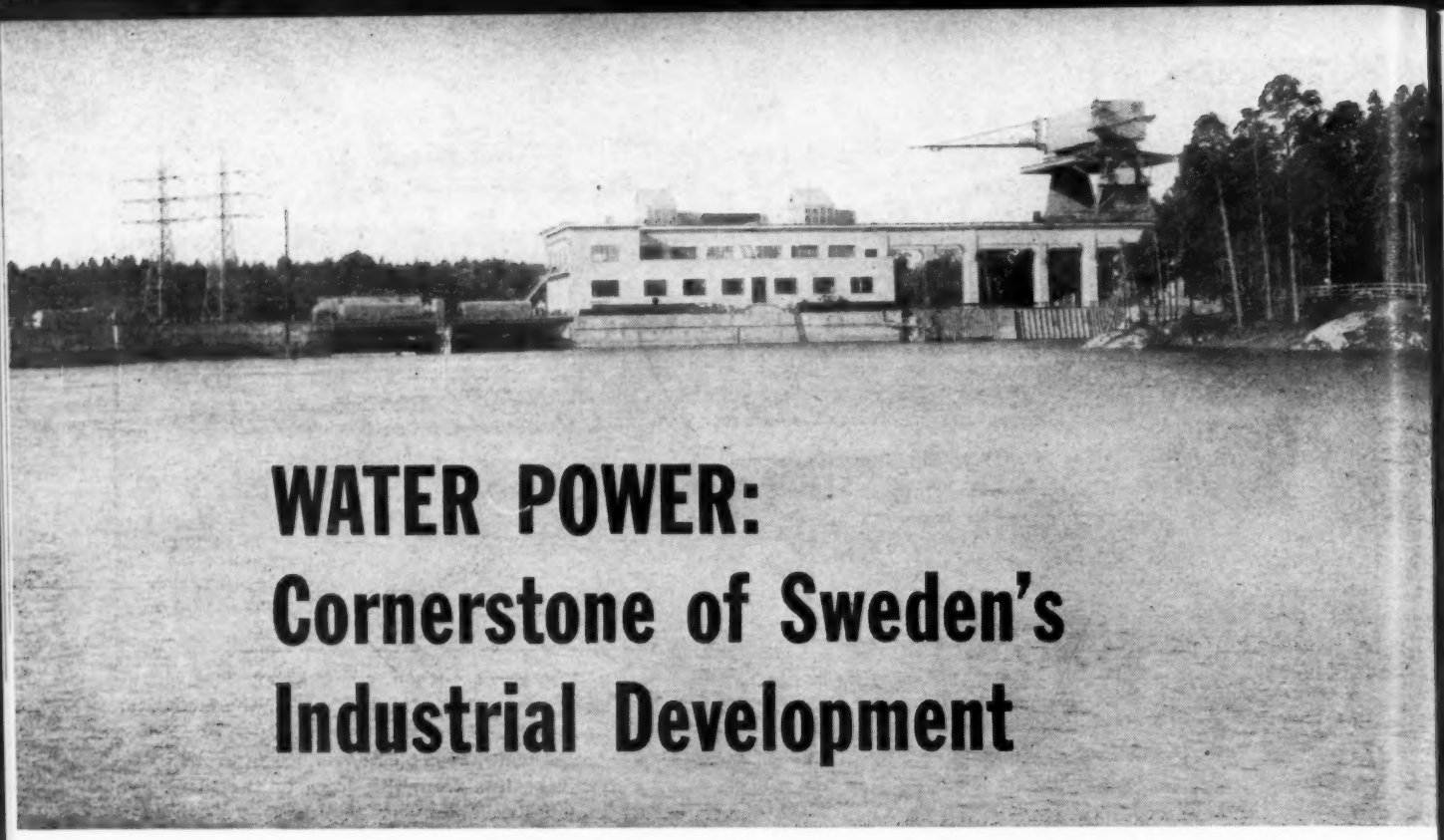
Theoretically, the chloride test should be ideal for concentration because chlorides do not undergo a change in the boiler as do alkalinities, but the endpoint reading is not always easy to determine with accuracy. I have had experience with waters where the color change with the usual silver-nitrate test did not give reliable results. When the water does, however, give reliable chloride readings, this test can be used. Alkalinity tests have the advantage of avoiding duplication of solutions since such tests are standard for hot- and cold-process treatments so often used in boiler-water conditioning.

Between the total solids and the alkalinity or chloride reading there is a definite relationship, which can be established by an evaporation to dryness test. The table illustrating blowdown-loss calculation is based on saturated steam and water at 200 psia. Method used is approximately correct for any other steam conditions.

HOW TO CALCULATE HEAT LOSS IN BOILER BLOWDOWN

Based on saturated steam and water at 200 psia and 382 F

1 Steam output, lb per hr	2 Blowdown, lb per hr	3 Feedwater, lb per hr	4 Blowdown, % of steam	5 Blowdown, % of feedwater	6 Btu, per lb of boiler water	7 Btu, per lb of steam	8 Blowdown loss, Btu, per lb of steam	9 Total Btu, absorbed, per lb of steam	10 Gross blowdown loss, %	11 Blowdown loss with flash tank, %
Assumed	*Assumed*	*Columns 1 + 2*	*Columns 2 ÷ 1*	*Columns 2 ÷ 3*	*Steam tables*	*Steam tables*	*Columns 6 × 4*	*Columns 7 + 8*	*Columns 8 ÷ 9*	*Column 10 × 0.46*
30,000	1,000	31,000	3.3	3.2	355	1,198	11	1 209	0.9	0.4
30,000	3,000	33,000	10.0	9.1	355	1,198	35	1,233	2.8	1.3
30,000	6,000	36,000	20.0	16.6	355	1,198	71	1,269	5.6	2.6
30,000	15,000	45,000	50.0	33.0	355	1,198	177	1,375	12.9	5.9
30,000	30,000	60,000	100.0	50.0	355	1,198	355	1,553	22.8	10.5



WATER POWER: Cornerstone of Sweden's Industrial Development

Vargon plant, at the outlet of Lake Vanern into Gotha River, has two kaplan turbines to operate under a 14-ft. head

Sweden, lacking coal and oil for fuel, has become one of the most highly electrified countries by hydro development, says Hans G Tonndorf, of American-Swedish News Exchange. Electrified lines now carry 86% of railway traffic

▶ ALTHOUGH ENDOWED with many natural resources Sweden has little coal or oil. With these two commodities ranking first and second, respectively, in Sweden's import trade her economy is highly vulnerable to international-trade disturbances such as occurred during the two World Wars. Accordingly, fuel economy has always commanded great attention.

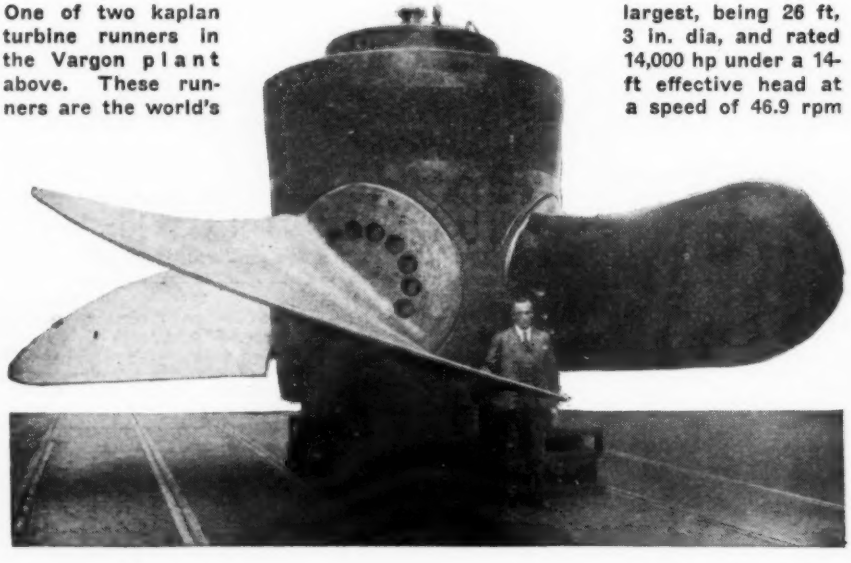
Mineral oil, which was almost nonexistent during the war, is again available. But coal supplies, although improving, are still far from adequate, with prices more than double those of prewar levels.

Fortunately, lack of coal and oil has not seriously hampered the country's industrial development because of access to abundant and comparatively cheap water power. With substantial "white-coal" resources, Sweden's industry has grown up in close relation with the rapid advances of hydroelectric power.

Today Sweden is perhaps the most highly electrified country in the world. More than 85% of all homes have access to electric power. Thus, in the rural districts electrification is remarkably high. Among the nonelectrified households 5% are so remotely situated that they cannot be furnished with electricity at a reasonable cost. Sweden's manufacturing industries, including home industries and handicrafts, have made extensive use of electrical energy.

Today 50% of the railroads in Sweden under State control are electrified. In terms of volume, as much as 86% of railroad traffic moves on the electrified lines, and electrification is still progressing. Early this year Bergslagens Jarnvags Co, the country's largest private railroad company, opened the newly electrified 350-mile line between the Swedish shipping metropolis, Gothen-

One of two kaplan turbine runners in the Vargon plant above. These runners are the world's largest, being 26 ft, 3 in. dia, and rated 14,000 hp under a 14-ft effective head at a speed of 46.9 rpm



burg, and Gavle on the Baltic sea coast, north of Stockholm.

As a result of the comprehensive electrification of its railway system Sweden saved about 7,000,000 tons of coal during World War II. This coal, if it had been available, would have cost about $138,000,000 compared with $90,000,000 actually spent during that period on electrical energy, including construction costs. Thus electrification of railroads not only provided uninterrupted traffic during the critical war period but also proved a profitable investment.

Sweden has a large number of rivers but most of them are not suitable for power generation. Many waterfalls are low and long. The water supply varies greatly between seasons, although this disadvantage is largely offset by the important role that 90,000 lakes play in water regulation.

A feature of Sweden's hydroelectric construction is the use of very low heads, which was made possible by the development of the kaplan turbine. An example of such an installation is the Vargon plant in the south of Sweden, page 82. Here the head is only 14 ft and the speed 46.9 rpm. Consequently, both turbines and alternators have to be of unusually large dimensions. The two turbine runners have the largest diameters in the world, 26.25 ft.

POTENTIAL WATER POWER

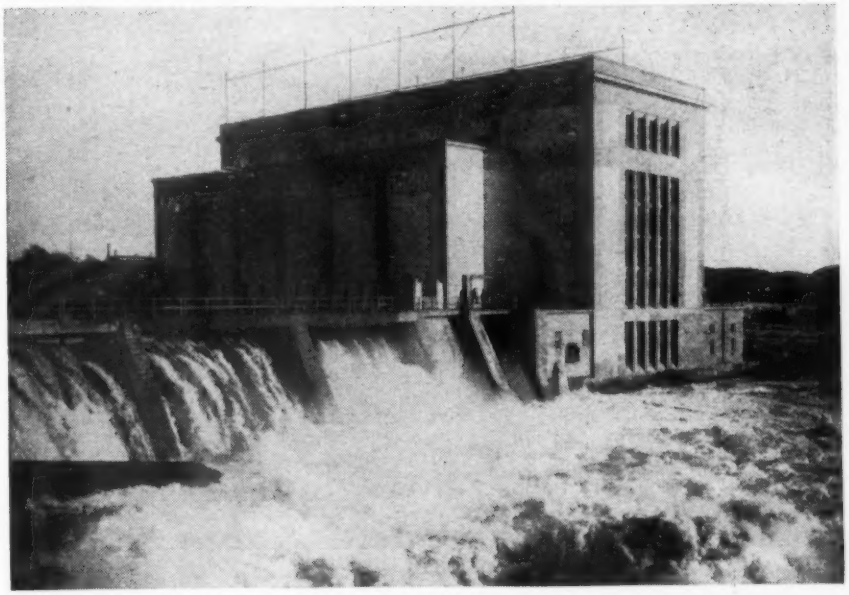
If all potential water powers in the country were developed they would produce about 100,000,000,000 kwhr per year. This is, however, a purely theoretical figure. Water-power resources possible to develop economically are estimated at only 36,000,000,000 kwhr per year. Of this, about 28,400,000,000 kwhr is in northern, 6,150,000,000 kwhr in central, and 1,500,000,000 kwhr in southern Sweden.

Almost 80% of the total potential power is in the northern section with a little over 1,000,000 inhabitants, or 15% of the country's population. Southern Sweden, on the other hand, with 25% of the country's population, has only 4% of the water-power resources. Therefore distribution of water-power reserves and population do not coincide.

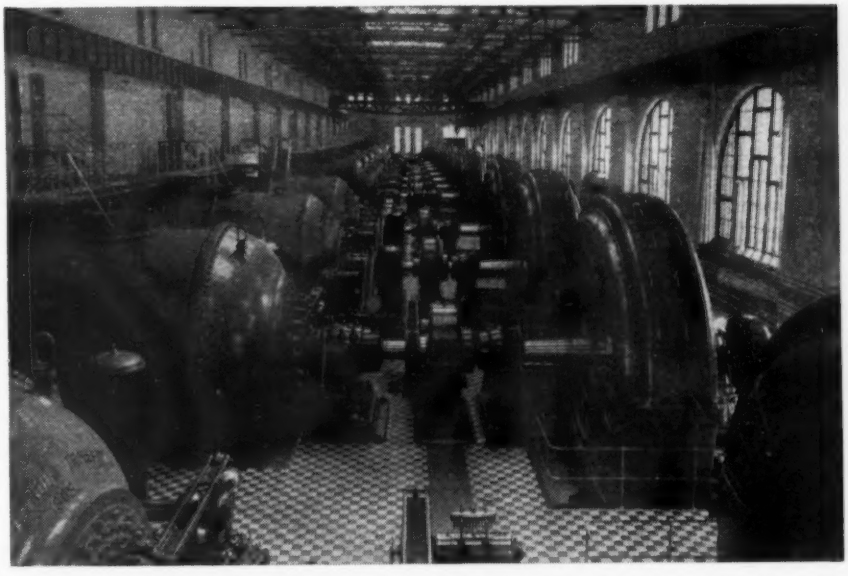
So it is not surprising that a much higher percentage of total power resources have been developed in the south and central sections than in the north. In the entire country hydroelectric capacity has been installed to generate 13,000,000,000 kwhr annually. This represents about 35% of the total available, but in central Sweden 80% of the local power resources are being utilized, the margin for further development being quite small. In the north, water-power development is well advanced on the Indals River, where 4,000,000,000 kwhr are produced annually out of a possible 6,500,000,000 kwhr, or 62% of the total available is used for power generation. But in other parts of the north most of the job is still ahead, particularly in the Skellefte and Torne River regions; where only 9% of a possible 12,900,000,000 kwhr has been developed.

With the largest water-power reserves concentrated in the north the eventual development of these resources will widen the distance between power production and consumption even more so that large quantities of electric power will have to be transmitted over long distances. Assuming full use of water-power resources there will be a need to transmit 16,000,000,000 kwhr per year from the north to the central and southern parts of the country in addition to the 4,000,000,000 kwhr now being used. At 200,000 v about 15 new main lines would be needed for the purpose.

In view of the high costs and other disadvantages of ac power transmission at 200,000 v it is hoped that in the future dc can be used at a higher volt-



Lilla Edet station on Gotha River has three 11,200-hp units under 21-ft head, at 62.5 rpm. One unit has a kaplan, the other two, Lawaczeck-type turbines



Trollhattan plant, on Gotha River, one of the largest in Sweden, has 13 units, originally rated 12,500 hp under 100-ft head; some modernized for 16,000 hp

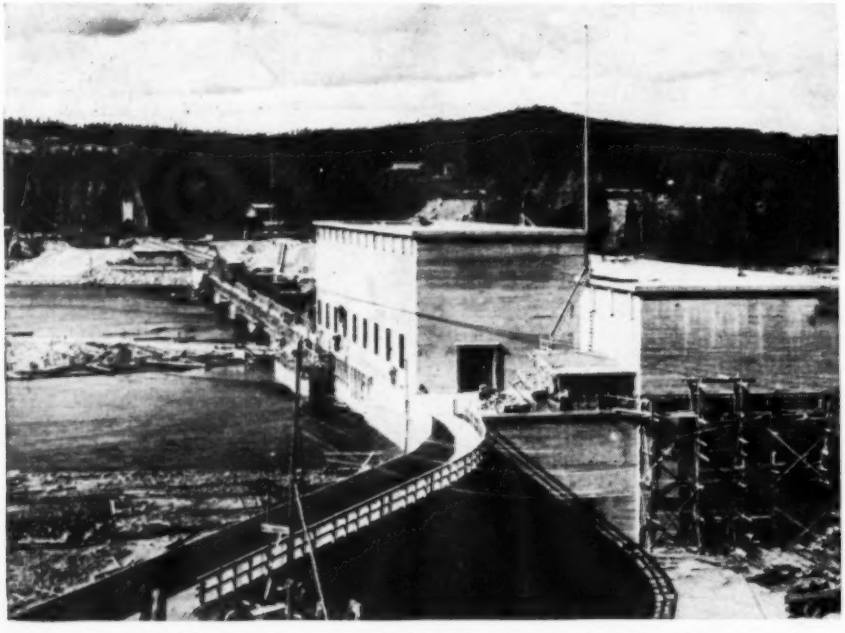
age. Studies are now being made on a line between Trollhattan and Mellerud in central Sweden. If this experiment proves successful the new power-transmission lines will be designed for dc at 400,000 v.

Power transmission from north to south is merely one aspect of the nationwide cooperation of the Swedish power industry. Most power plants of any size—State, municipal or privately owned—are interconnected and cooperate in a system of planned power for the whole country. As a result, each plant can be more fully utilized with a resultant saving in the total capacity required.

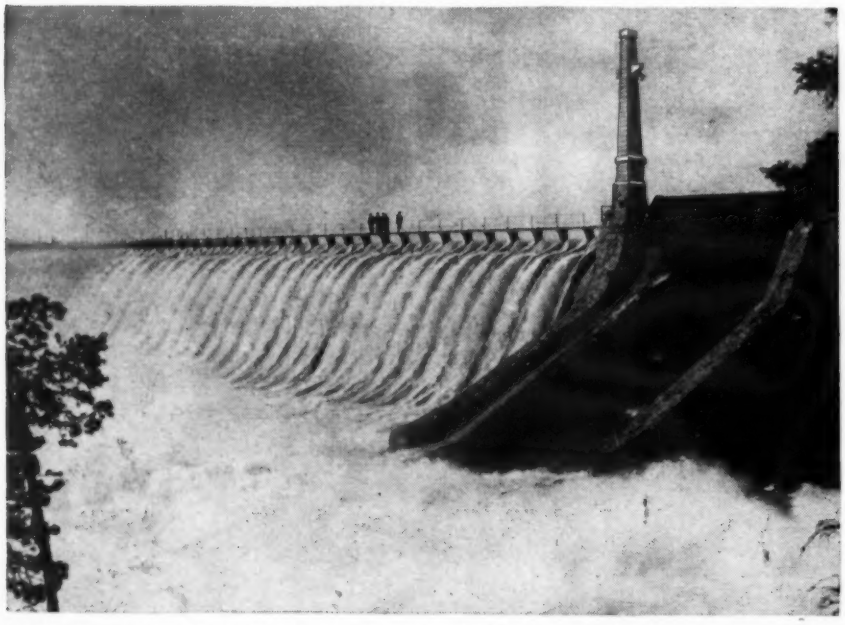
Transmission of electric current over long distances raises the problem of "international exchange of electricity" which has been given much thought in Sweden. That country's participation in such trade has been restricted to occasional exports to Denmark. In such an exchange the greatest benefits to Sweden would result from obtaining a power supply from cheap-power countries, particularly Norway. Southern Norway is no farther from southern Sweden than the Swedish northland, and its generating costs are lower. Further advantages could be obtained if this plan could be extended to include the German Ruhr district. Instead of moving coal from the Ruhr or other Continental sources to generate steam power it would be more convenient to get it in the form of electricity.

Up to World War I steam power had been the chief source of electrical generation in Sweden. Since then, power development has been hydroelectric. This has not rendered steam power unnecessary as a reserve.

For a long time, it has been profitable to many power systems to install steam plants to secure maximum production from hydro plants during lower-water periods. With nationwide coordination of the power industry steam power has lost some of its importance to individual systems but not to the country as a whole. Today steam power is provided by a few large plants such as the 110,000-kw station at Vasteras in central Sweden. During a normal year steam plants do not supply more than 2% of the total power requirements. In dry years, however, more than 6% of total energy is supplied from steam plants.



Gammelange 40,000-kw plant on the Indals River in northern Sweden, operates in combination with Krangede 175,000-kw station to suppy 12% of Sweden's power



Dam for Porjus plant, 29 mi north of Arctic Circle, has turbine and generator room cut in solid rock; has seven 12,500- to 18,000-hp units for 174-ft head

PLANT CONSTRUCTION

With the end of the war Swedish power industry was looking forward to a huge expansion of its production facilities. During the war several plants were completed but, because of material shortages and other difficulties, only comparatively few projects were started. There has been a steady increase in power-plant construction. From 1925 to 1943, inclusive, new power-generating capacity averaged 43,000 kw annually, but it went as high as 133,000 kw during the period from 1940 to 1945.

New construction during 1946 was only 36,000 kw, but will increase to 135,000 kw in 1947, and 176,000 kw in 1948, with even higher increases ahead during following years.

War construction was concentrated chiefly on the Indals River, but for the next three years it will be on the Angerman and Fax Rivers. Later, projects will be developed even farther north. Next year, construction will be started at the Harspranget, the largest waterfall in the country, on the Lulea River. Upon completion in 1952 the Harspranget plant will have a total of 250,000 kw, installed, as against the 220,000 kw of Trollhattan, near Gothenburg, now the largest power plant of Sweden.

Proper Fan Installation Reduces Operating and Maintenance Costs

J P Holtzclaw, manager of the service department, Buffalo Forge Co, gives important pointers on selecting, installing, operating, maintaining plant forced- and induced-draft fans

▶ PROPER CARE AND MAINTENANCE, necessary for any mechanical equipment, are indispensable in the successful operation of mechanical-draft fans. Although they are not complicated, they are vital to any boiler installation being served. Amount of maintenance depends upon the kind of operation and care given, as well as the duty the fan performs and how essential a part it plays in functioning of other equipment in the plant.

Fan Selection. Much maintenance is avoided if the correct size and type of fan are applied to each job. A study of boiler conditions determines the type of control and drive best suited for the fans, such as damper control or variable-speed drive, steam-turbine or electric-motor drive, or some combination.

Variable-speed drive on induced-draft fans reduces erosion on the rotor blades and fan casing to a minimum. There are many cases where the peak load occurs infrequently, and then only in emergencies. Normal operation is carried on the boiler most of the time, but the fan has to take care of the peak as well. By reducing fan speed the gas velocity through the fan decreases and minimizes the wear; an added advantage is the reduction in horsepower.

Where boiler load does not fluctuate below normal rating very much a 2-speed motor can be used to advantage.

Present-day power plants require heavy-duty fan equipment with good bearings to stand up under continuous operation. Heavy construction will last longer without undue trouble.

Some thought should be given to future conditions before fans are chosen. It is natural to expect fans to come up to design conditions when they are new and complaints are few. But occasions arise when higher boiler ratings are wanted or new equipment is installed. Fan ratings have to be increased to meet the new requirements. Extra equipment adds resistance to the system, which means a decrease in capacity. This has to be made up and possibly increased by raising the fan speed or by changing the fan equipment if no margin was allowed in the original conditions of air and pressure. Any fan-speed increase should be checked with the manufacturer before putting into practice.

Fan manufacturers can make suggestions and advise on duct layouts, fan characteristics and control for the installation that are not covered by specifications.

Here are some tips for selecting mechanical-draft fans:

1. Be sure fan rotors have a static and dynamic balance at the factory.

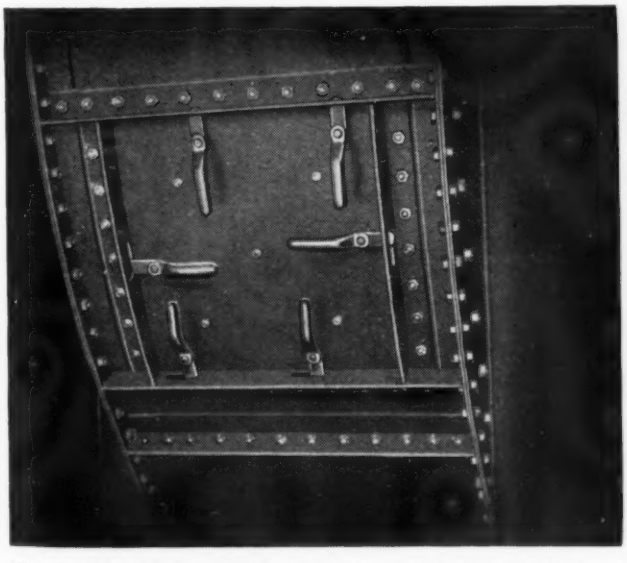


Fig. 1—All fans should have conveniently located access or cleanout doors that open easily for inspections

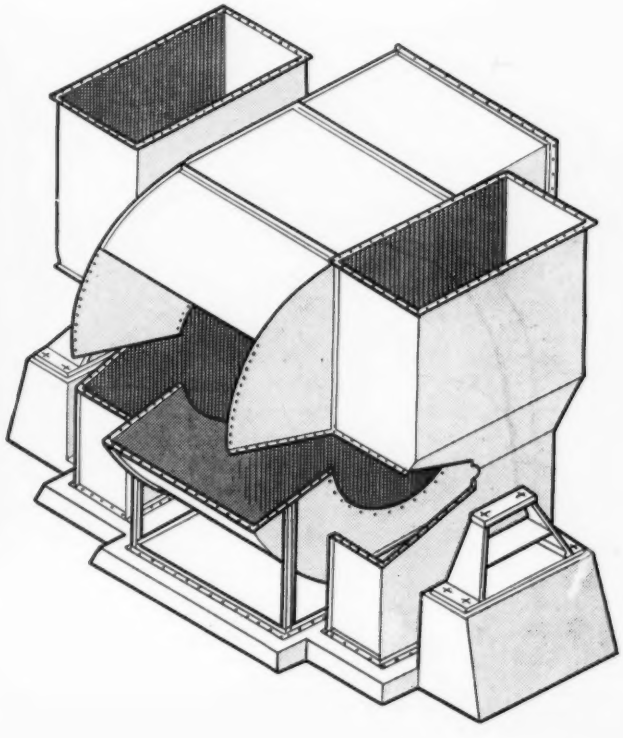


Fig. 2, right—Every fan must have provisions for removing fan rotor without disturbing inlet and discharge duct connections. Here removable section in fan casing permits taking out rotor and shaft for maintenance needs

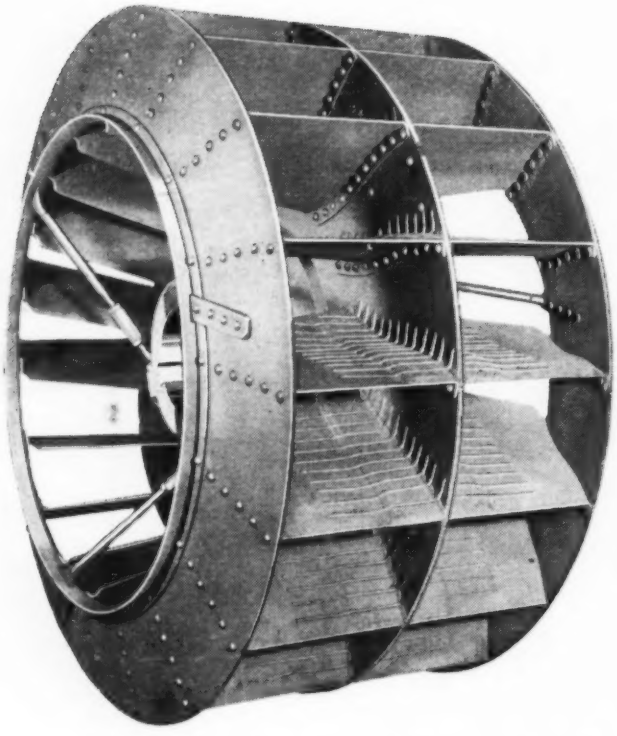


Fig. 3—Backward-tipped-blade powdered-fuel rotor of induced-draft fan has wearing strips and welded ridges

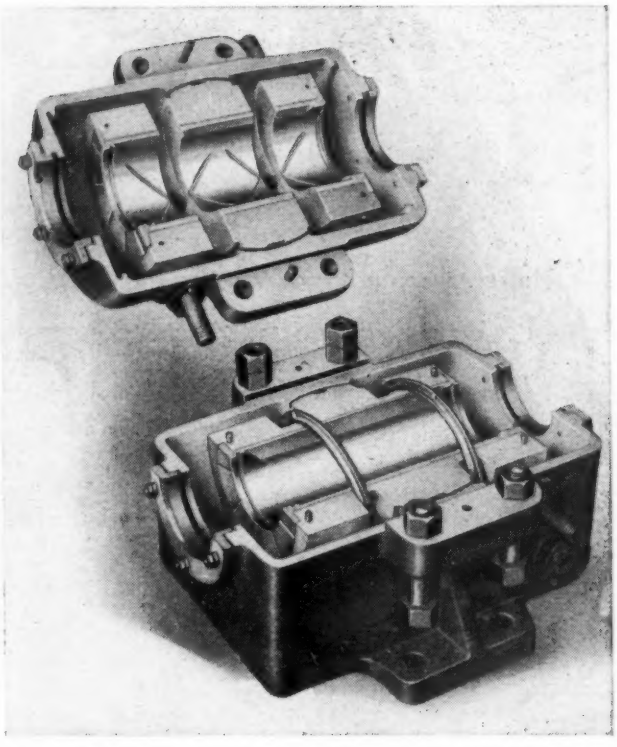


Fig. 4—Bearings for induced-draft fans should be the sleeve-type, watercooled, self-aligning for easy removal

2. Fans should have conveniently located access or cleanout doors that are easy to open, Fig. 1.

3. Make provision in fan casing for rotor removal without disturbing duct connection to fan inlet and discharge. Three ways of doing this are by providing: (a) removable plate in fan side (b) removable section in fan casing so rotor and shaft can be removed as a unit (c) removable section in the fan-casing scroll, Fig. 2.

4. If the induced-draft fan is expected to wear, specify wearing strips and welded ridges on the rotor, Fig. 3, and scroll liners for the fan casing, Fig. 6. These prolong fan life.

5. Bearings should be self-aligning for replacement ease, and of ample size. For induced-draft service they should be sleeve-type, watercooled and self-aligning. Bearings with separate water-cooled sleeve liners are easily removed, Fig. 5. Ball or roller bearings are all right for forced-draft service but have not proved satisfactory for heavy-duty induced-draft service.

Installation. When the fans are first installed precautions will prevent costly shutdowns. Here are some of them:

1. Solid foundations and supports are important since they prevent a lot of unbalance trouble. This is particularly true of induced-draft fans because, usually, they are not on the ground, but four to six floors up; so their duct connection is short from boiler to fan to stack. Upper floors being less steady than the ground, stiffness and weight have to be added to fan supports. Steel work must not only hold the fan dead weight but also take care of the rotating effect, which increases with unbalance. Building frequencies have to be kept out of tune, or phase, with the fan frequency, or the serious vibration trouble that develops will cause damage to the building as well as other equipment. This can be corrected to a certain extent by filling in the steel work with concrete. An approximate rule would be to have the weight of concrete base for fan equal 2.5 to 3 times the fan weight, including drive and clutches.

2. After properly aligning fan with driving element it should be doweled and grouted into place to keep it from shifting. Misalignment not only causes wear in the coupling but in bearings as well, and also affects fan balance.

3. Practically every fan is now balanced at the factory before shipping, but it should be checked after installation as rough handling in shipping and erection may disturb it.

4. Induced-draft fans should have expansion joints on both intake and discharge connections.

5. Duct connections should be made to fit the fan without disturbing fan setup and alignment.

6. There should be a run-in period before the fan goes into service to check on operation, balance and bearing temperatures. After run-in, bearings should be checked, flushed out, and supplied with clean oil.

Periodic Inspection. All mechanical draft fans require periodic inspections, and records should be kept of conditions, such as amount of wear, balance, alignment and lubrication, to help in scheduling repair work. Inspections pay dividends in the end, reduce chances of shutdowns that could have been avoided. Inspections are usually

SUGGESTED FAN-VIBRATION TOLERANCES

Fan speed, rpm	Vibration displacement, mils			
	Smooth	Fair	Rough	Very rough
600	2	4	8	15-20
900	1.5	2.75	6	8-10
1200	1.0	2	4.5	6-8
1800	0.75	1.5	3.5	5-7

Note: *Fair* is not bad, but should be improved. *Rough* should be balanced as soon as possible. *Very rough* is too rough to operate.

made when the boiler goes out of service for inspection and repairs.

Inspection of forced-draft fans should not cause much trouble for they handle relatively clean air at normal temperatures. Clean wheel if dirty; check bearings, flush out and put in fresh oil, and check alignment.

Induced-draft fans should have a more rigid inspection. If the fan serves a pulverized-coal or stoker-fired boiler there is the problem of wear as well as temperature to contend with unless provisions have been made by using dust collectors to remove flyash from the flue gas before it reaches the fan. Amount of wear depends on the grade of coal, combustion, boiler type, load, and how the boiler is fired. Fan wear on a pulverized-coal boiler usually exceeds that on stoker-fired units. Wear affects fan balance as erosion does not occur uniformly over the blade surface.

Besides the items listed for the forced-draft fan, induced-draft fans should be checked for wear; worn parts should be built up with weld metal or replaced, if necessary. Bearings on induced-draft fans are, as a rule, sleeve-type, watercooled. Water jackets should be cleaned if cooling water is dirty.

Spare parts should be kept on hand for all wearing surfaces, such as, coupling bushings and bearing lines. Sometimes a spare fan rotor and shaft are kept on hand because it is quicker to change the rotor than to repair it in place.

Fan Balance. A fan running in an unbalanced condition gets steadily worse and causes serious trouble, such as, wearing and burning out bearings, weakening bearing supports, loosening piping and surrounding equipment, springing the fan shaft and possibly damaging the fan wheel itself.

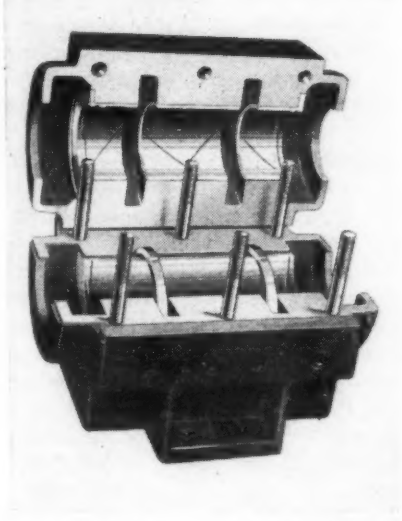


Fig. 5—Rigid-type watercooled bearings are also used on power-plant fans

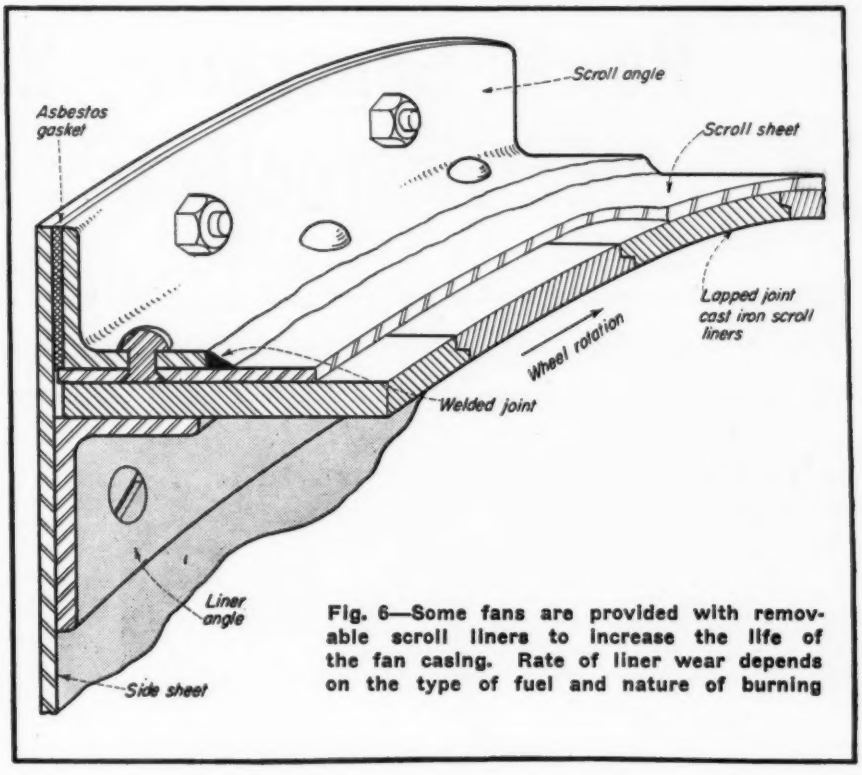


Fig. 6—Some fans are provided with removable scroll liners to increase the life of the fan casing. Rate of liner wear depends on the type of fuel and nature of burning

Commonest causes of unbalance are wear, misalignment, weak foundations, bent shaft, bad or worn bearings, and dirt on the rotor blades.

Induced-draft fans usually have relatively long bearing centers as they are double inlet, and have inlet boxes with the bearings on the outside, which tends to make them more sensitive to balance. Single-inlet fans have relatively short bearing centers, and are not so sensitive to balance.

Amount of unbalance can be measured by a vibration meter. There are various types with varying degrees of sensitivity, such as mechanical, optical and electrical. No hard and fast rule has been made on what vibration tolerances should be. Some power plants have set up their own tolerances, which should be based on the fan rpm. The table gives an average guide.

Balancing methods include the old trial-and-error procedure and the portable balancing instruments, which are being used quite frequently. Before balancing a fan rotor, check: (1) all foundation bolts for tightness (2) wheel tightness on shaft (3) bearing condition (4) wheel cleanliness (5) alignment (6) shaft trueness, then proceed.

The trial-and-error method consists of chalking the shaft with the fan running, and putting on weight to correct the unbalance. This takes time and a lot of patience. For a balanced fan the chalk mark shows the same weight line all around the shaft. On an unbalanced fan the line length around the shaft shows the relative amount of unbalance; a very short line indicates a very rough fan. In placing trial weights initially, mount them opposite the heavy mark. Then run the fan and rechalk the shaft. If the mark center shifts, shift the weight so the mark center holds the same as the original. After finding the proper weight location add more weight until the chalk mark goes around the shaft.

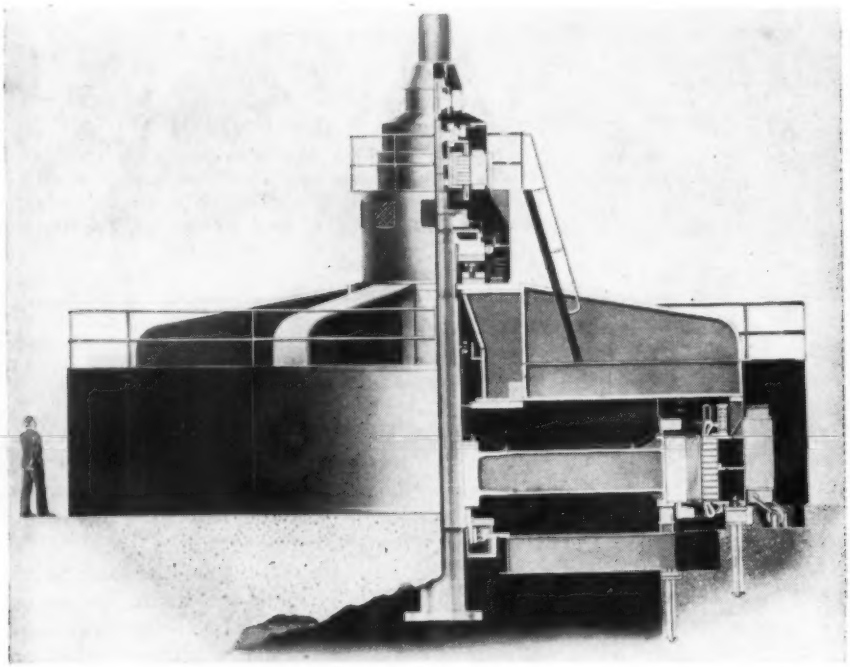
On a double-inlet fan, both of its sides have to be chalked as one side of the rotor varies from the other at times. It is possible to have a chalk mark around the shaft, and still have the fan rough. This indicates weak fan supports or that the fan vibration is in frequency phase with some other piece of rotating machinery.

Portable balancing-instrument methods give the locations and amount of weight to use. One instrument consists of a sine wave alternator, vibration-velocity unit and indicating instrument. The usual procedure records a set of

(*Continued on page* 146)

Power Generation Highlights AIEE Hydroelectric Session

Thrust-bearing practice on vertical machines, recording waterwheel governor operation, automatic control of hydro generating stations, hydro-turbine characteristics that affect efficiency



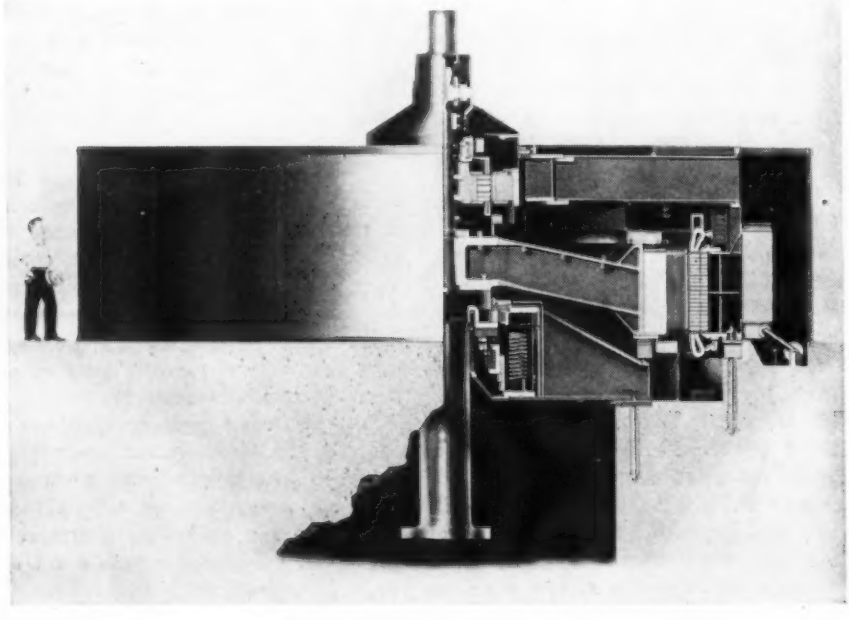


Fig. 1 (above)—Medium-speed vertical waterwheel generator with guide bearings that operate in an oil bath. Fig. 2 (below)—Umbrella-type generator combines thrust and guide bearings in a single unit below the generator rotor

▶ WITH THE MOST COMPREHENSIVE PROGRAM in its history, the American Institute of Electrical Engineers held its winter convention in New York City, Jan. 27 to 31. At 53 sessions and conferences, nearly 200 papers and discussions presented practically the whole range of technical subjects of interest to over 3000 electrical, power and industrial engineers who were present. Papers dealing with hydroelectric-plant practice are here given in part.

Modern Bearing Practice. C M Laffoon and R A Baudry, Westinghouse Electric Corp, reviewed modern bearing practice for vertical waterwheel generators. These units require guide bearings to position the rotating parts, and a thrust bearing to support their weight and the thrust load of the water head. In normal practice the thrust bearing and its supports are provided as part of the generator. Speed and proportions of turbine and generator parts are such that the turbine requires one guide bearing, and the direct-coupled generator, one or more guide bearings.

BEARING ARRANGEMENTS

Fig. 3, 4 and 5 show the three principal bearing arrangements developed to meet operating requirements of waterwheel-generator units for a wide range in dimensions, proportions, weights and speeds. For high-speed units, for which the ratio of rotor diameter to core length is small, two forced-lubricated sleeve guide bearings are placed on the shaft as close as possible to the rotor; and the thrust bearing located above the generator, Fig. 3. This arrangement permits using minimum-sized guide bearings with low friction losses, but requires a rather complex lubricating and cooling system.

On medium-speed machines with a higher ratio of rotor diameter to core length, a similar bearing arrangement is used, Fig. 1 and 4, but the guide bearings operate in an oil bath to eliminate the complicated lubricating system. With this design the top guide bearing is on the thrust-bearing runner; consequently its losses are somewhat higher than for a sleeve bearing placed on the shaft. The losses are kept within reasonable limits by using pivoted pads,

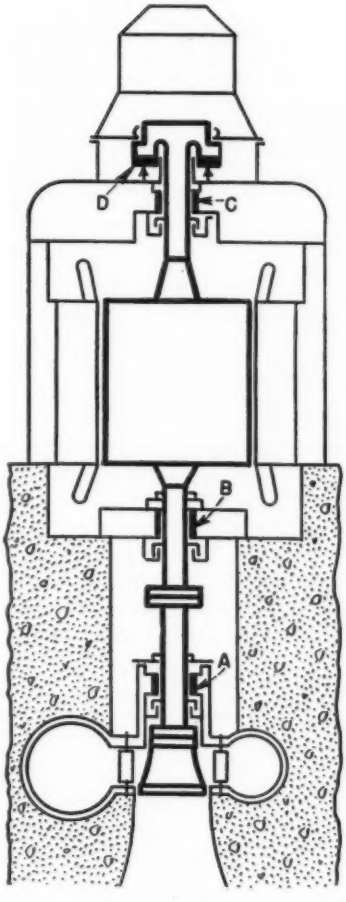


Fig. 3—Thrust and guide bearings on a high-speed vertical hydro generator

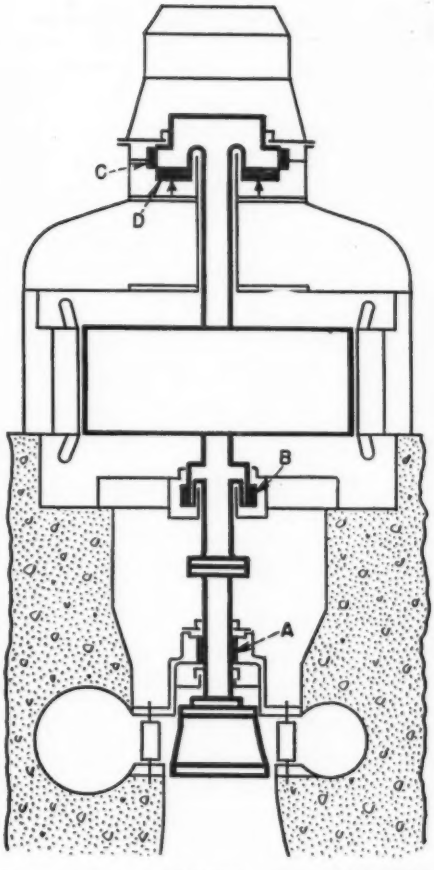


Fig. 4—Thrust- and guide-bearing locations, medium-speed hydro generator

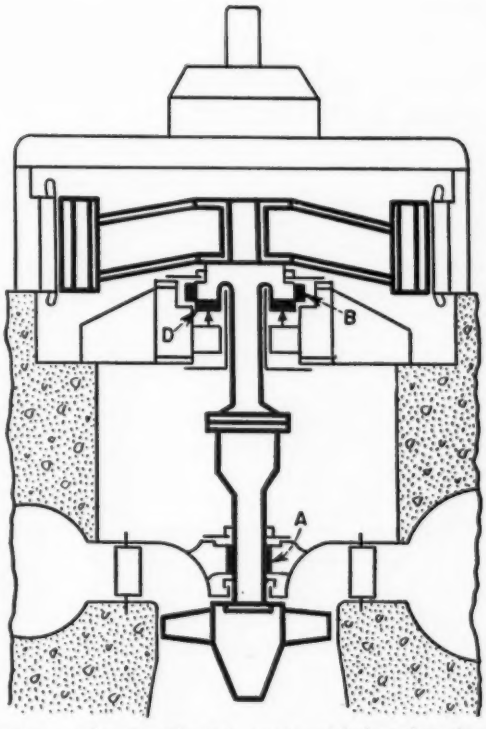


Fig. 5—Thrust- and guide-bearing locations, umbrella-type hydro generator

which have a high carrying capacity and make possible a smaller bearing area.

For low-speed units, with a higher ratio of diameter to core length, the single guide-bearing generator is used extensively as its low height requires a power station of low headroom. This generator is commonly known as the umbrella type. The thrust bearing, placed under the rotor with the single pivoted-pad guide bearing, operates in the same oil bath, thus reducing to a minimum the bearings and lubricating system of the machine, Fig. 2 and 5.

Bearing Performance. Pivoted-pad thrust bearings have an excellent record of reliability when properly installed, lubricated and maintained. They give years of service with practically no wear; many bearings inspected after more than 20 years of service show original machining marks on the babbitt. At normal speed a film of clean oil separates the bearing surfaces. Wear occurs only during starting and stopping. Finish of bearing surfaces and oiliness of the lubricant are important, particularly for bearings that start frequently. Laboratory and field tests show that the coefficient of friction is much higher when starting than when stopping. When starting, the bearing runner is not carried on an oil film until a speed of 20 to 30 rpm is reached, but when stopping, it is still carried on an oil film down to a speed of 1 rpm.

Smoothness of the rubbing surfaces and lubricant oiliness improve appreciably with time. Therefore, when placing a machine in service, several temporary measures should be taken to increase the bearings' factor of safety during this period when the machine makes many starts at high temperatures while drying out the windings.

Speed, at which the bearing rides entirely on an oil film, increases with lubricant temperatures to such an extent that, with a high starting temperature, bearing failure is likely to occur. So do not start a waterwheel generator unless oil temperature is kept below 45 C.

Many horizontal electric machines have oil pressure under their journals when being put in service, to reduce starting friction, and keep current inrush to a minimum. This feature greatly reduces the bearing strain. Oil pressure lift is not necessary on waterwheel generators since there is ample power to break away the thrust bearing. Also, installation of oil lift on the several tilting pads of a thrust bearing is complicated even though it has been done on a few vertical motors where low-starting torque is required.

The same effect, however, can be obtained by jacking up the rotor, with the hydraulic jacks normally provided. Oil is thus introduced between the bearing surfaces, and remains there for an appreciable time after the jacks are released. If the machine is started immediately, bearing friction is comparable to that obtained with oil-pressure lift. This method of starting, when used for the first 40 or 50 starts, increases the bearing factor of safety while the bearing surfaces and lubricant are improving.

New Frequency Recorder. J E Allen, Pennsylvania Water & Power Co, and W B Hess, Safe Harbor Water Power Corp, described the mechanical and electrical features of a new frequency

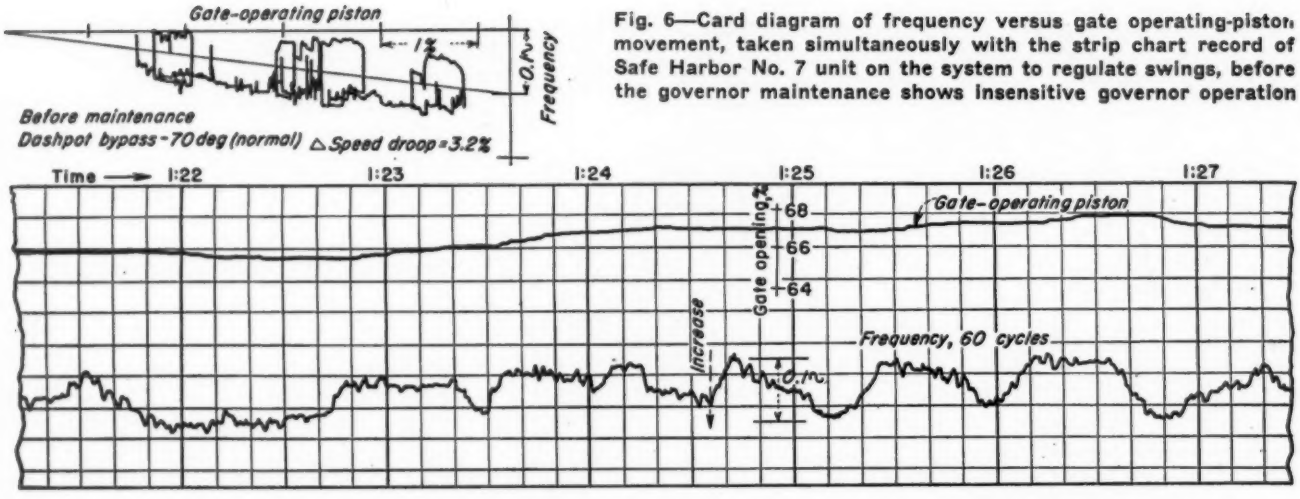


Fig. 6—Card diagram of frequency versus gate operating-piston movement, taken simultaneously with the strip chart record of Safe Harbor No. 7 unit on the system to regulate swings, before the governor maintenance shows insensitive governor operation

recorder, the essential element in an instrument for automatically plotting diagrams of frequency versus operating piston movement, or frequency versus kilowatts. Also given were results obtained by using the instrument as an aid to maintenance of governors and for measurement of their performance.

The equipment has been used extensively in checking governor performance at the plants of the Safe Harbor Water Power Corp and Pennsylvania Water & Power Co. These plants are part of an interconnected system in an area that includes eastern Pennsylvania, New Jersey, Maryland, Delaware and the District of Columbia. Generating capacity of the system is in excess of 4,000,000 kw. There is no automatic frequency control; handling frequency for electric time is regulated manually by a designated station with all other frequency regulation taken by the individual unit governors.

During low-river-flow periods the governors of hydro units at Safe Harbor and Holtwood are free to assist the other stations on the inter-connected system in regulating frequency. For effective regulation and economy of operation it is important to have correct governor action free of hunting, creeping and other irregularities. To this end testing equipment has been a valuable aid in locating malperformance and in measuring the effects of adjustment and corrective measures.

Governor Maintenance. The routine checks of governor performance have been used as a guide for determining when governor maintenance or adjustment is needed. Fig. 6 shows the performance of a governor before a periodic maintenance and inspection period. The strip chart indicates poor governor action in that the gate operation piston has a tendency to follow only the general trend of the average frequency and offers little helpful operation in regulating the load swing. The card diagram of frequency versus operating piston position, taken simultaneously with the strip chart, shows an insensitive governor with the average width of diagram approximately 0.1 cycles per sec, or 0.17% of rated speed. This type diagram indicates friction in the governor's primary element.

Maintenance inspection revealed friction in the main relay-valve packing gland, the ball-head bearings, and compensating dashpot plungers, also an 0.08-in. off-center setting of the small dashpot plunger. The chart, Fig. 7, shows the operation of this same governor after the faulty conditions were corrected. The strip chart shows a decided improvement in governor performance, with the gate system following all major frequency swings with little time delay. The card diagram indicates an average sensitivity of 0.05 cycles per sec, or 0.8% of rated speed.

Conclusions Reached. The authors reached the conclusion that (1) the

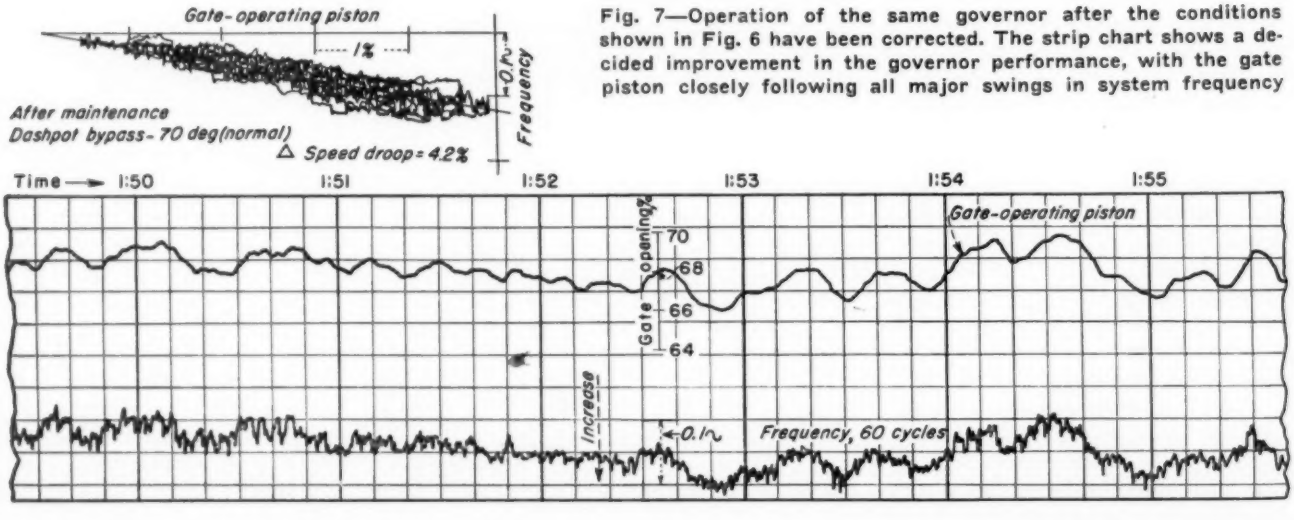


Fig. 7—Operation of the same governor after the conditions shown in Fig. 6 have been corrected. The strip chart shows a decided improvement in the governor performance, with the gate piston closely following all major swings in system frequency

many factors affecting governor performance are readily shown and can be evaluated by the card diagram and strip-chart record. Maintenance and adjustment effects and corrective measures are, therefore, quickly and easily determined. (2) Method of testing with card diagrams of frequency versus gate movement offers a convenient means of establishing practical governor performance standards and maintaining them throughout the life of the equipment. (3) Adoption by the industry of testing methods similar to those described would provide a common basis for analyzing governor performance. More general use of this testing method would be promoted by the early adoption of suitable terms defining the characteristics of the frequency versus gate diagram obtained during operation.

Hydroelectric Equipment. M J Brown and W A Derr, Westinghouse Electric Corp, described hydroelectric station equipment, operating procedure and the factors involved in applying automatic control. They outlined two common methods for accelerating the generator and synchronizing it with the system. In one method, termed self-synchronizing, the machine circuit breaker is closed at less than synchronous speed and the machine synchronizes after its field is applied. In the other method automatic speed-matching and synchronizing equipment bring the machine on the line at correct voltage and phase angle. Also presented were considerations in applying supervisory control to automatic hydroelectric stations.

AUTOMATIC CONTROL

In the authors' opinion hydroelectric stations are particularly well adapted to automatic control. Since they are economically justified only if their operating expenses are in keeping with the value of their generating capacity, many small installations must be completely automatic to compete commercially with other power sources. An important consideration is the random availability of their generating capacity. Except in large installations, hydroelectric power must be considered as an auxiliary to steam power. It can be used either for short periods, when extra generating capacity is needed, or for long periods, when an abundance of hydroelectric power is available. Automatic control of hydroelectric stations is favored by the relative simplicity of control of both the prime mover and the stored hydraulic energy that drives it.

Hydraulic - Turbine Efficiency. J F Roberts, Allis-Chalmers Mfg Co, in a paper on *Characteristics of Hydraulic Turbines That Affect Operating Efficiency*, expressed the opinion that in a power system, possibilities and variations in operating procedure multiply with the number of plants and different types of plants. They are further complicated by a combination of hydro and steam plants.

Simplest power system to operate is an isolated one with only one turbine. This one unit must be operated to supply the load requirements as they occur. As long as the unit is properly maintained and in good condition, little remains that can be accomplished, even though the operating superintendent has a perfect understanding of the unit's efficiency characteristics.

Next in simplicity is a single plant with several duplicate turbines installed. A simple rule to follow here is to carry the required load with the minimum number of units possible in operation. The curves, Fig. 8, show that at half load the efficiency of practically all hydraulic turbines is less than at full load. The fixed blade propeller has 63.5% efficiency at half load, as compared with 86% at full load. Only for kaplan and impulse wheels is there any doubt of this statement, where half-load efficiency of these units might be 1% better than full-load. Even here, only one unit should be operated until it is loaded up to about 98% of its capacity.

Second fundamental rule for this type of system is: Divide the load equally on similar units. Efficiency curve's shape on all hydraulic turbines is fairly similar in that the curve rises sharply at part loads, and gradually flattens out until point of maximum efficiency occurs, but it is convexed upward. Assuming that the load is just in excess of that required for one unit, two units at half load give better performance than one unit at ¾ and the other at ¼ load.

Third type of system in order of complication is one with two or more plants, each with a multiplicity of units. Alternatives regarding complications in system arrangement could be increased to infinity, but in general the efficiency expert's problems on the operating staff of a large power system increases with the number and type of plants interconnected.

Other conditions considered were storage systems, steam and hydro plants, spinning reserve, air venting, tailwater depressing, governing, exciter and service units, leakage through wicket gates performance curves and other features.

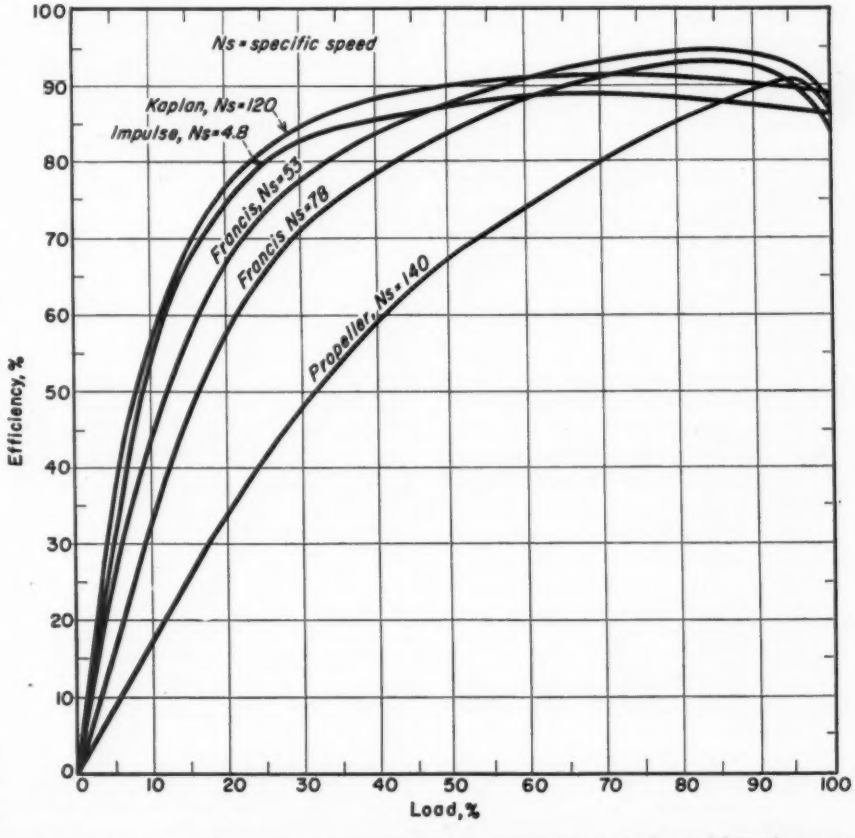


Fig. 8—Shape of efficiency curves of kaplan, propeller, francis and impulse runners used in hydraulic turbines for heads ranging from the lowest to highest

Must Diesel Engines Smoke?

Not if well designed, in good repair and operated on normal fuels without overload, says P H Schweitzer*, who presents an unusually complete analysis of the causes of smoke and those design and operating conditions that influence its production

▶ IT IS WELL KNOWN that almost any diesel engine will smoke if it is overloaded, the fuel is wrong, or certain operating conditions are off, but a confusing thing about diesel exhaust smoke is that it results from apparently contradictory causes. Many loosely related data have been collected and conflicting theories put forward in explaining them. The theory here presented makes no pretense of having been arrived at by pure reasoning. It represents hindsight rather than foresight, even if it is presented as though it had all been figured out beforehand and the experimental verification sought afterwards.

What Is Smoke? To start with a definition: For our purpose here, exhaust smoke is a discoloration or opacity of the exhaust gas *as it leaves the cylinder*. The discoloration is always caused by presence of liquid or solid particles in the exhaust gas. Liquid particles (fog) consist of unburned fuel or lubricating oil; solid particles (soot) are generally carbon particles resulting from incomplete combustion of hydrocarbons. Unburned liquid-oil particles impart a white color, droplets of lubricating oil a bluish tinge, and soot particles a gray-brown color varying from light gray to brown-black.

There are other potential sources of exhaust discoloration, such as condensed water vapor and inorganic materials or ash. Amount of inorganic compounds in the fuel is insignificant, however, and condensation of exhaust products at the exhaust port can be excluded. With these reservations, we may say that smoke is always the product of combustion that is still in progress when the gas leaves the engine cylinder.

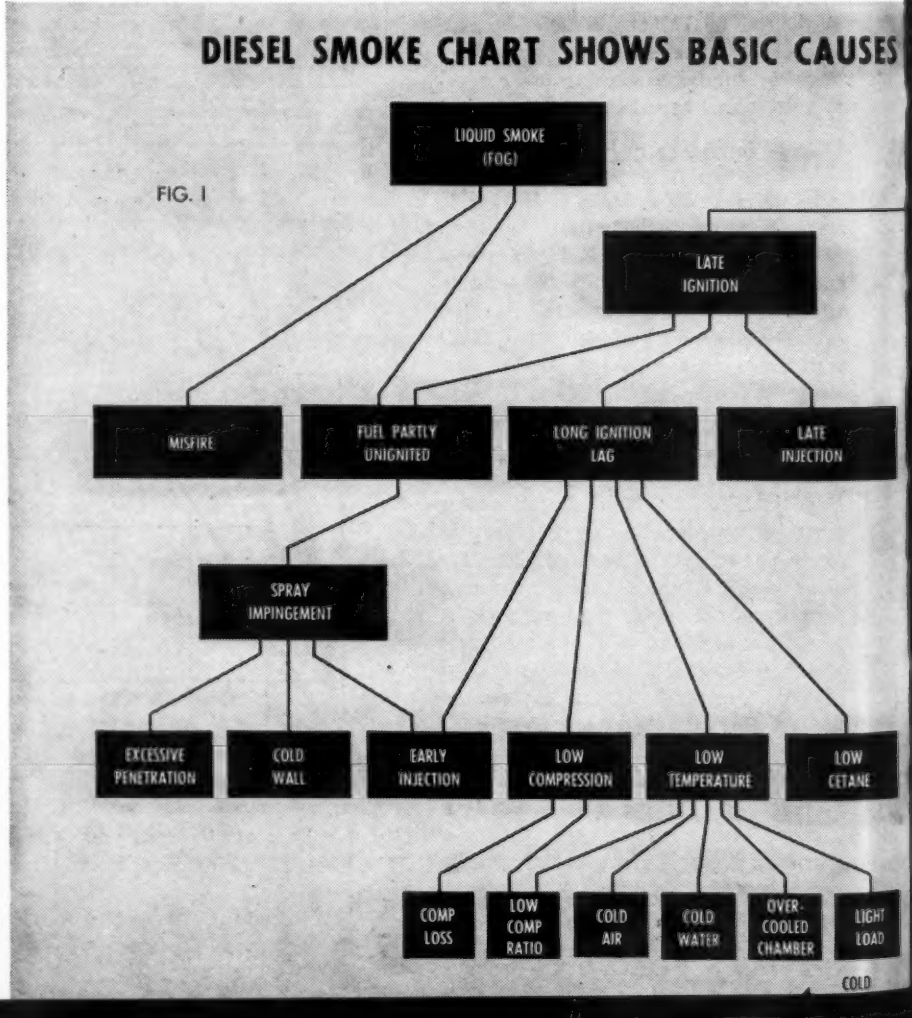
Incomplete Combustion. If combustion is completed inside the cylinder, combustion products are gaseous and invisible. If combustion is in full progress when the exhaust opens, both flame and smoke will appear. Luminous combustion may be over at exhaust opening yet smoke will result from post-flame combustion. Misfire is an extreme case, as luminous combustion has not even begun at time of exhaust and still, as far as it puts unburned fuel in the exhaust, it causes exhaust smoke.

In this sense, it is correct to say that there is only one cause for exhaust smoke—incomplete combustion—and, as a corollary, combustion unfinished when exhaust opens is always accompanied by smoke. Even without knowledge of combustion chemistry, this single fact opens the door to many useful conclusions.

Two Kinds of Smoke. Conscious of the fact that they seldom appear singly, it is still useful to analyze the two kinds of exhaust smoke separately. One may be called "hot" smoke; it results from sluggish burning of fuel particles. The other is "cold" smoke and results from fuel particles, ignited too late or not at all. A typical example of hot smoke results from overloading, while cold smoke results from light idling.

Turning our attention to the engine, we may say that exhaust smoke, manifesting unfinished combustion, may be the product either of misfire or of late burning. Misfire represents the case where combustion has not yet begun when exhaust opens, while with late burning, combustion is still going on when exhaust opens. Misfire produces

FIG. 1



* Abstracted from a paper presented by Prof P H Schweitzer, engineering experiment station, The Pennsylvania State College, before the annual meeting of the Society of Automotive Engineers, Detroit, Mich., Jan 6 to 10, 1947

cold smoke while late burning produces hot smoke. We must not forget that because the diesel cylinder charge is not homogeneous both hot and cold smoke frequently appear side by side, because some fuel particles ignite but fail to complete their combustion while others fail to ignite at all.

Delayed Combustion. Late burning may be caused by either sluggish combustion or late ignition. Sluggish combustion means too low a burning rate and produces hot smoke. Late ignition means too long an ignition lag, and results in cold smoke consisting of fuel particles ignited late or not at all.

Further analyzing late burning, we find that, for the most part, factors that promote sluggish combustion oppose late ignition, and vice versa. This is an example of the fact that smoke often results from apparently contradictory causes. To assist in visualizing the origins of exhaust smoke and their relationships, the chart of Fig. 1 has been prepared. Basic causes are showing at the bottom, with effects above.

Air-Fuel Ratio. Most important factor causing incomplete and, therefore, sluggish combustion is an overrich mixture. Fuel burned with a deficiency of oxygen produces soot. For diesel fuels, the chemically correct air-fuel ratio is approximately 14.5 to 1. Diesel fuel burned in the presence of less than the correct amount of air produces smoke irrespective of operating conditions. But even if the over-all air-fuel ratio is less than correct we may still have an overrich mixture in spots, with resulting smoke. This is the commonest cause of exhaust smoke.

Carburetor engines behave better in this respect than diesels. The carburetor provides a more-or-less uniform air-fuel mixture, and if the ratio is correct or leaner the combustion is clear. Because of the nonuniform distribution of fuel in a diesel, it usually requires 50 to 100% excess air to obtain clear combustion.

Turbulence and Mixing. Everything that improves mixing tends to reduce local overrichness and so improves smoke conditions. Poor atomization and spray distribution, and insufficient turbulence cause local overrichness, and hence smoke. All of these may be classified as mixing difficulties. Poor spray dispersion may cause smoke, even at light load, but it will surely aggravate matters at heavy load when the over-all air-fuel ratio has a smaller margin. That makes good mixing of the fuel and air the most important single factor in raising the output of a diesel engine.

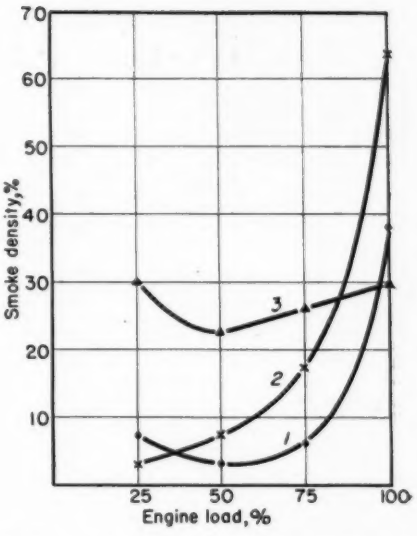


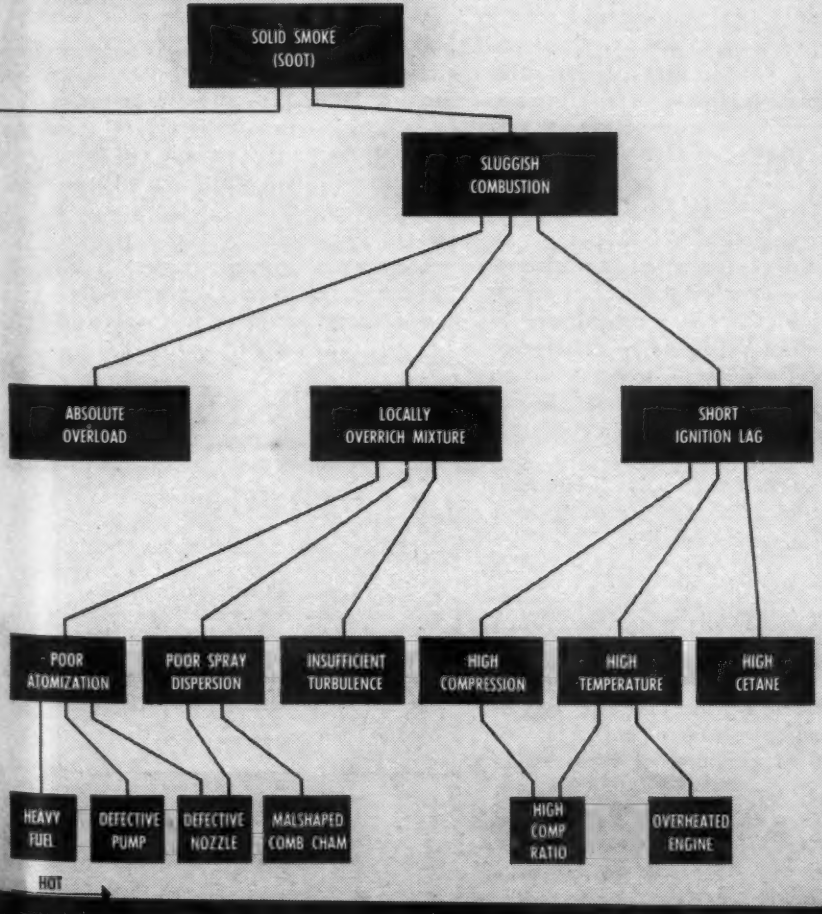
Fig. 2—In "normal" engine, curve 1, smoke density tends to increase at light load as well as at heavy load. In unit with hot-combustion chamber, curve 2, smoke density does not rise at low loads, while with cold combustion chamber, curve 3, smoke density at light loads is as high as at full

Short Ignition Lag. A less well-known set of conditions causing sluggish combustion is indicated on the chart, Fig. 1, as "short ignition lag." Any factor that causes an exceptionally short ignition lag promotes smoke. Fuels of over 60 cetane number are usually smoky but the same effect results with ordinary fuels at exceptionally high-compression ratio. Two explanations are offered as to why short ignition lag ruins the mixing process. First, ignition occurs before the spray has traveled any distance from the nozzle tip. Amount of air near the nozzle is insufficient to support adequately combustion of the injected fuel, and air situated farther from the nozzle has little chance to take part in the combustion so the fuel burns with a deficiency of air.

The other explanation is that with short ignition lag, ignition takes place virtually without explosion and the indiscriminate turbulence usually caused by explosion is missing. Thus the mixing process suffers and the result is smoke.

In any case, exceptionally short ignition lag is conducive to smoke irrespective of whether it is caused by high-cetane fuels or other reasons. Also,

AND THE RELATIONSHIPS BETWEEN THEM



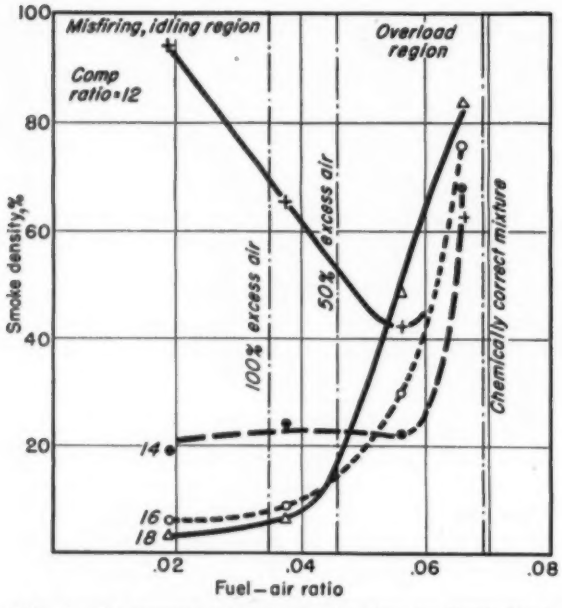


Fig. 4—As curves reveal, smoke due to light load can be corrected by high-compression ratio, and smoke due to heavy load can be mitigated by a low-compression ratio.

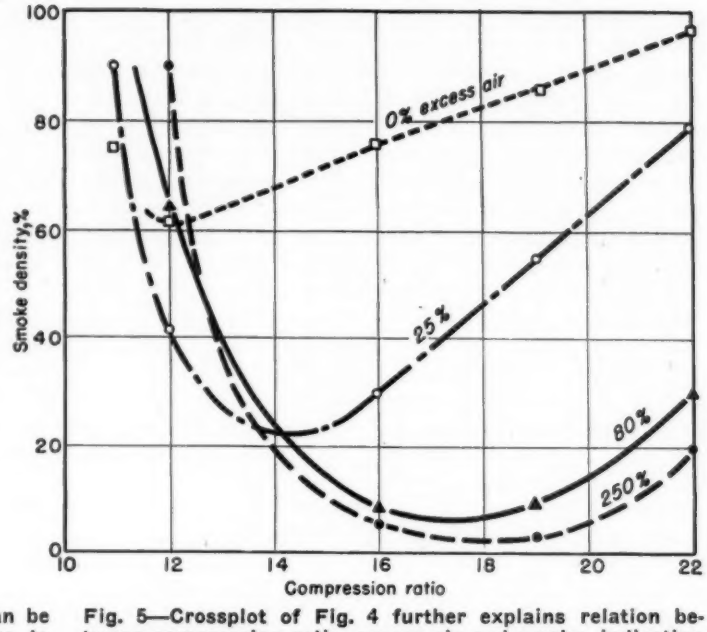


Fig. 5—Crossplot of Fig. 4 further explains relation between compression ratio, excess air and smoke, indicating that, in general, a medium-compression ratio is the best

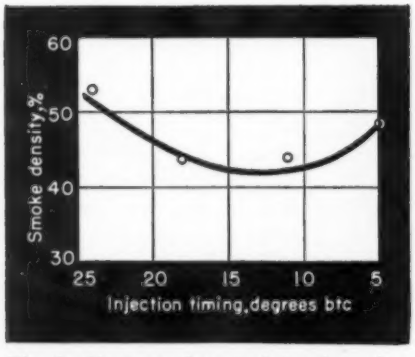


Fig. 3—Up to a given point, advancing injection timing increases smoke density but if carried too far "cold" smoke results, and perhaps misfiring occurs

smoke caused by short ignition lag is not nearly as dense as smoke resulting from other sources.

Late Ignition. The other general cause of smoke is late ignition, for which we may visualize three stages. In the first and severest case, the charge fails to ignite completely; in the second case, some of the fuel particles ignite but some do not; and in the third, all the particles ignite but some fail to complete their burning before exhaust opens.

The first case, misfire, produces nothing but a mixture of vaporized fuel and unvaporized fuel particles. The unvaporized portion appears as fog. In the second case, we are dealing with a mixture of fog and soot, the latter coming from incomplete combustion of fuel particles. The third case presents ordinary soot, not distinguishable in appearance from smoke produced.

The end results of late ignition and sluggish combustion may be indistinguishable, but each originates from an entirely different set of causes and elimination of the smoke requires elimination of the causes. A useful rule to remember is that any condition that may cause misfire will, in a smaller dose, cause late ignition, and on the border-region of misfire any diesel will smoke. For this reason it is justifiable to designate the result of both cases as cold smoke, and consider misfire merely as an extreme case of late ignition.

Late ignition may be caused either by late injection or by long ignition lag, or a combination of the two. Late injection can be corrected simply by advancing the injection timing. As a matter of fact, the first practical step to eliminate smoke should be an advance of injection timing. If by such an advance, smoke clears without the engine becoming rough, we can stop right there.

Long Ignition Lag. But if late ignition results from too long an ignition lag, it cannot be corrected by earlier injection. Too early injection makes ignition lag longer because fuel is introduced into relatively cold air. Thus earlier injection does not produce earlier ignition and may even have the opposite effect. The remedy lies in increasing compression temperature or compression pressure, or compression ratio, which increases both. Use of extra-high cetane fuel represents a temporary expedient that may be useful for an experimental engine but is generally undesirable in regular operation. Frequently the cause of long ignition lag lies in a chilled combustion chamber. By design changes the combustion chamber can be made hotter all over or in the spot where it counts most.

If ignition of the charge occurs so late that part of it fails to ignite at all, we find spray impingement or deposition of liquid fuel particles on metal. Once liquid fuel comes in contact with relatively cold metal walls it will never burn but will blow out through the exhaust as fog, or leak down past the rings and dilute crankcase oil. If metal temperature is high (over 900 F) the fuel may ignite and burn completely but if spray hits a cooled surface it

(*Continued on page* 164)

CORRECTION

In the table of new steam plant installations appearing in the Jan 1947 issue of POWER, on page 71, the Atlantic City Plant of the Atlantic City Electric Co was erroneously listed as installing a 34,000-kw unit in 1948. This station had a new 30,000-kw unit that went into operation in 1946.

C BROOKS HUDSON: A POWER PERSONALITY

This farm boy had the initiative to acquire engineering skill and to go after better jobs. By study and work he came out on top as Chief

C Brooks Hudson's eyes sparkle as he studies drawings for a new feedwater heater in his boiler room. To him, it is fun to prepare plans and to supervise construction

► FOR SIXTEEN YEARS C Brooks Hudson made constant moves to get ahead, but when he finally found a job where he could carry out his ideas he settled down and has stayed put for 26 years. He is chief engineer of steam and power of the Plymouth Cordage Co, North Plymouth, Mass.

Constant engineering study has always stimulated his interest in planning a job thoroughly before breaking ground. During his long service with the company he has supervised design and installation of many plant changes and additions, laying out equipment and making drawings, which are submitted with proposed apparatus for approval. He has rebuilt the boiler room by discarding sixteen out of twenty 1600-sq-ft hrt boilers, reset two 5000-sq-ft straight-tube boilers, and installed two new 5000-sq-ft straight-tube boilers. In the engine room he has two new steam turbines, one 2000 kva and one 500 kva. He keeps his plant in excellent working condition by the simple philosophy, "get on top of trouble before trouble gets on top of you."

Brooks first engineering interest was a wooden model of a steam engine, which he built as a thirteen-year-old boy in Vermont. At the ninth grade he had to quit school and go to work on a nearby farm. Later on, he left the farm, and got a job in a creamery. Here he had his first chance to operate an engine (50 hp) and small boiler.

From the creamery, Hudson went to Lowell, Mass., as oiler in the power station of the Boston and Northern Street Railway. He stayed two years, long enough to study up and get a first-class fireman's license—the only grade issued at that time. From here, he went to Federal Shoe Co to fire two small boilers. While on this job he passed the examination for a third-class engineer's license.

HARD WORK DOES THE TRICK

In August 1907, Hudson started working for Lamson Store Service Co of Lowell. "On that job," he said, "I fired three 64-in. hrt boilers and wheeled in all my own coal as well as that for the night man. I wheeled out all the ashes, watched a 150-hp engine part time, and was weekend watchman. All in all, I worked 84 hours a week for $16.80."

Brooks managed to secure a second-class engineer's license in the two years he was on this job. Making use of this license later, he went back to the Boston and Northern power plant. Although at 27 he was the youngest engineer on the force Hudson decided to try to better his position so he went to Tremont and Suffolk Cotton Mill.

He was still using his second-class license. An attempt to secure a first-class license had been turned down with a suggestion that he get out and take charge of a plant of his own. For this supervisory experience, he went to U. S. Bobbin and Shuttle Co, of Lowell, where he had complete charge of a small plant—less than 150 hp. Hudson wanted to work into a larger plant so he went to Lowell Electric Light Co, where he had a chance to operate his first steam turbine—1500-kw vertical. Here he studied for and received his first-class engineer's license. Intent on improving salary and experience, Hudson tackled a job as assistant chief engineer of Malden Electric Co.

"You know," said Brooks, "I got my first chance as chief engineer by answering an 'ad' in POWER, which I have subscribed to over 35 years. Ford Bacon and Davis were remodeling the Ithaca Traction Corp. power plant and were advertising for a plant super. I really went after that job and now I'm glad because it gave me my first real start."

Hudson left Ithaca and went to Woronoco, Mass., as chief engineer for Strathmore Paper Co, and later to American Writing Paper Co, Holyoke, Mass. In 1920, while at Holyoke, he was asked to go to Plymouth Cordage as chief engineer.

Much of Hudson's success is the result of study. He started with an International Correspondence School course in electrical engineering, which taught him mathematics, drafting, electrical and mechanical engineering. Added to this, a program of reading and studying keeps him abreast of modern engineering ideas and improvements.

Hudson has a winning smile for everyone. He is a good talker, with a wealth of experience to draw from. Aside from his great engineering interest, Hudson is an enthusiastic fisherman. He delights to angle for brook trout in the clear New England streams. He likes to do things with his hands and has become expert at making artificial flies.

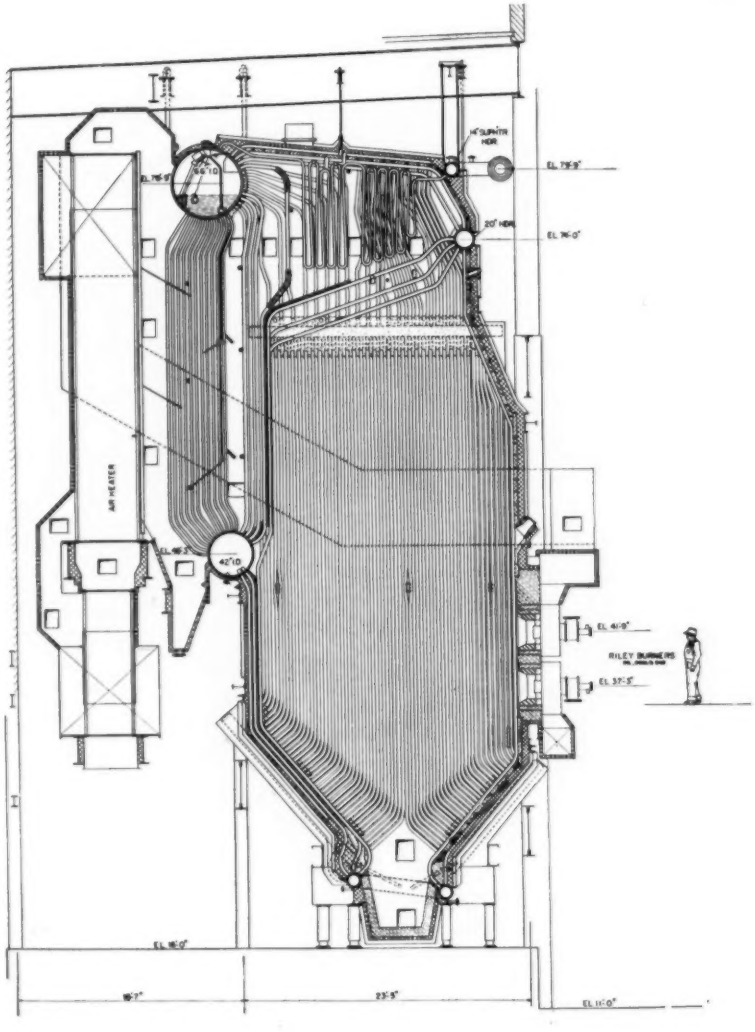
One of the largest oil refineries on the east coast

installed their first Riley Steam Generating Unit in 1934, a duplicate in 1937, still another in 1939, and just completed the installation of their fourth Riley Unit last year.

Positive evidence of the complete satisfaction being obtained from Riley Steam Generating Units is the regularity with which users of Riley units place repeat orders for more Riley units when installing additional steam generating capacity.

Take the case of two of the world's largest oil companies. One installed their first Riley unit in 1934 and because of exceptionally satisfactory results placed orders during the past 12 years for three additional units for this plant plus another Riley unit for another plant. The other installed their first three Riley units in 1935 and have ordered five additional Riley units for their California refineries plus eleven Riley units for their foreign refineries.

This is typical of what is happening throughout industry. Almost invariably once a company installs Riley units they repeat for more Riley units. Isn't that positive evidence that you can rely on Riley?



300,000 lbs. of steam per hour. 750 lbs. pressure.
750°F. temperature. Oil firing. 86% efficiency.

TRADE MARK Rx REGISTERED

RILEY

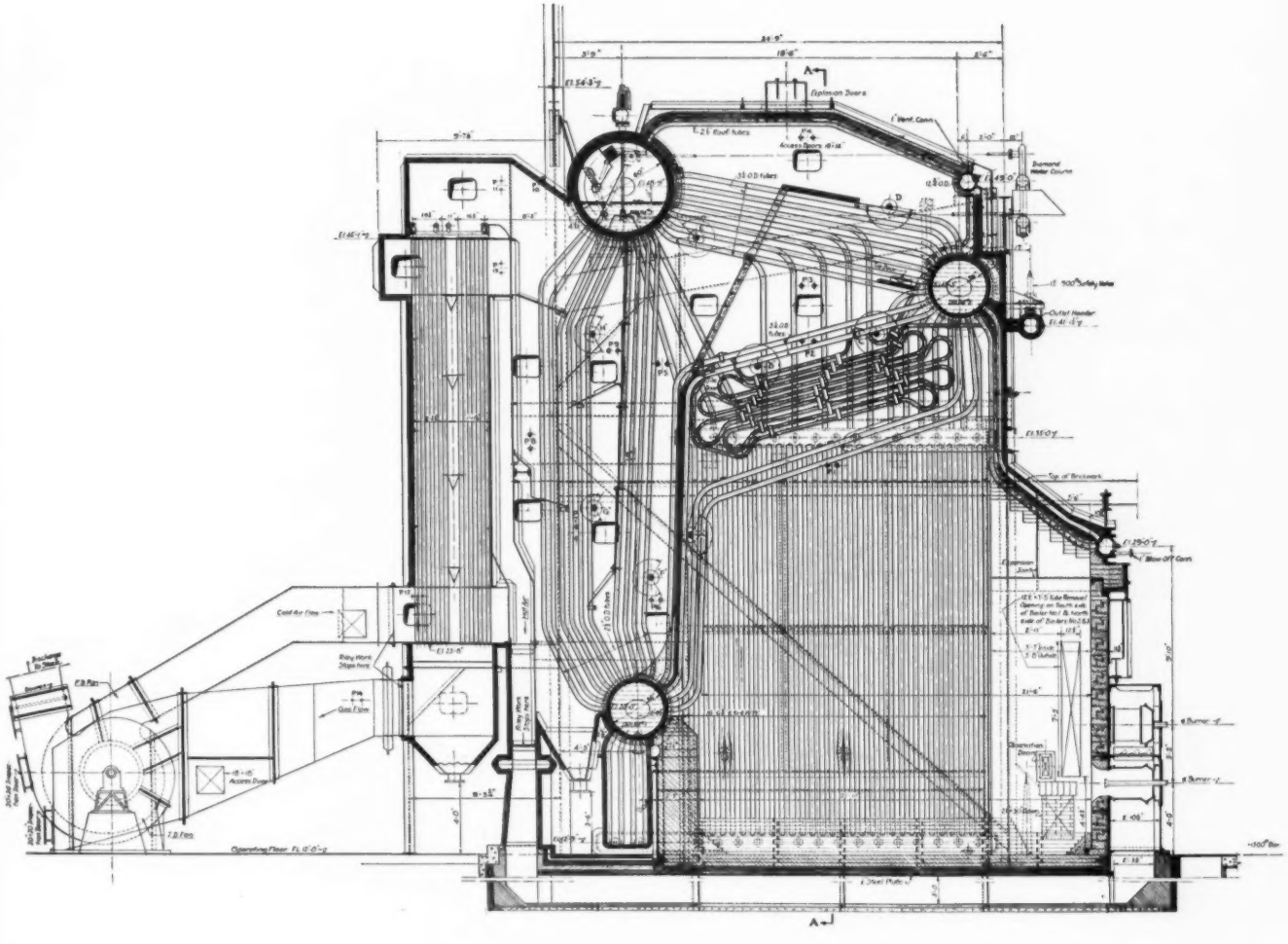
STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

It will pay you to visit modern Riley Installation

One of the largest oil refineries on the west coast

installed their first Riley Steam Generating Unit in 1935, a duplicate in 1941, still another Riley unit in 1942, and are installing three additional Riley Units this year.



**165,000 lbs. of steam per hour. 900 lbs. pressure.
750°F. temperature. Gas and oil firing. 84.8% efficiency.**

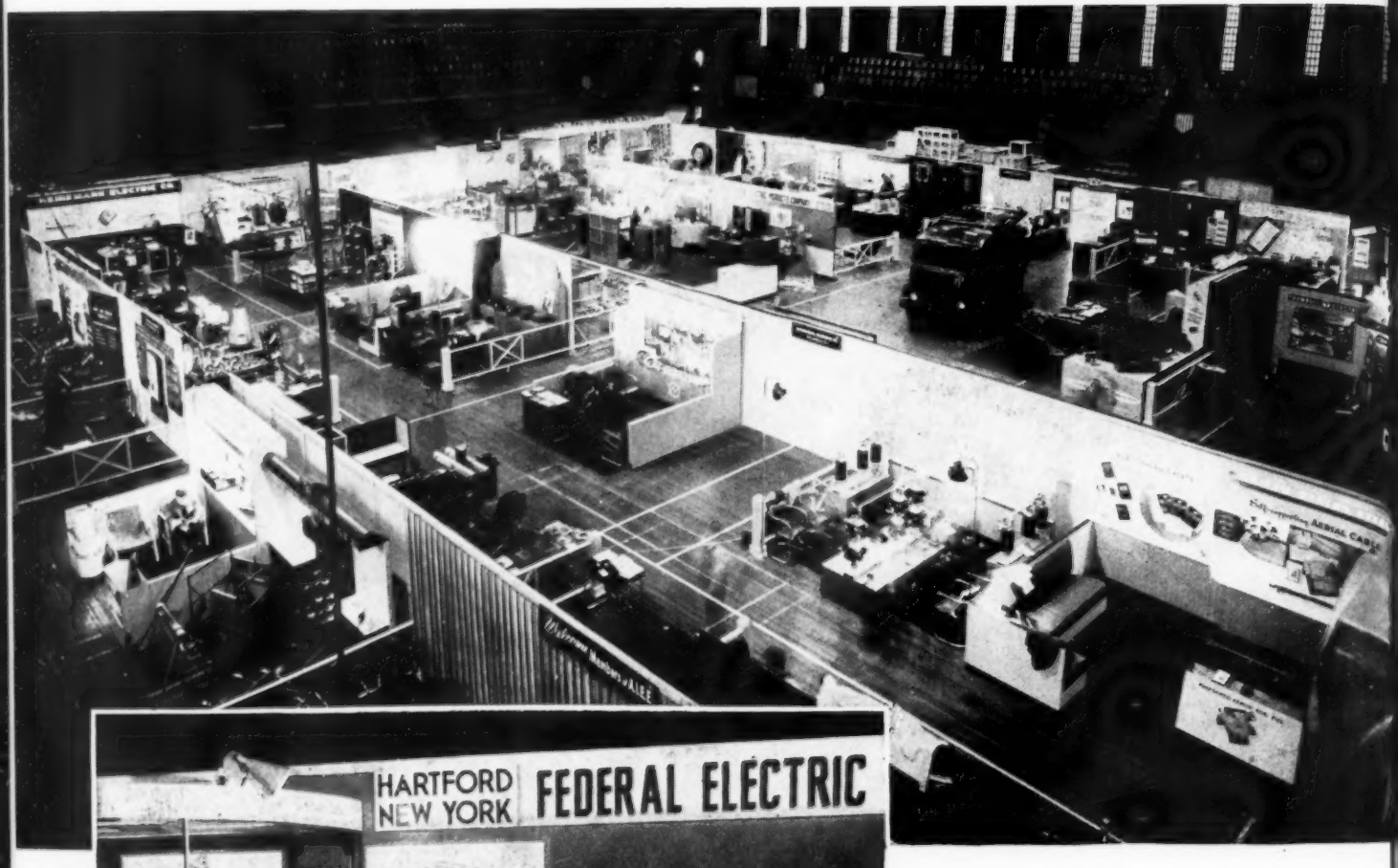
A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

...efore purchasing Boiler or Fuel Burning Equipment

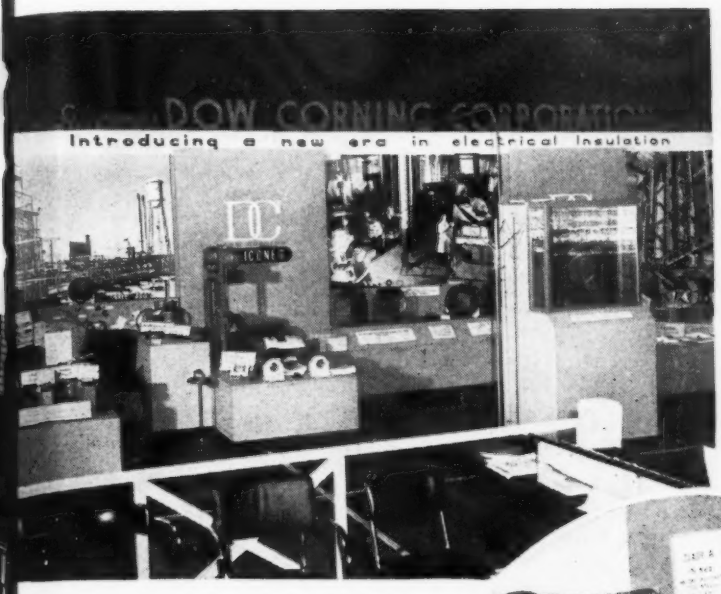
New Equipment Displayed at First Electrical Engineering Show



Electronic-motor control operates a dc motor from an ac source, thus incorporating variable-speed characteristics of dc motor. Control device maintains constant speed up to full load, protects motor from overload even at stalled rotor conditions. In this exhibit a generator and hand brake provide different loads while stroboscopic light illuminates shaft under changing conditions

▶ THE ELECTRICAL ENGINEERING Exposition, Jan 27-31, 71st Regiment Armory, New York City, held concurrently with the AIEE winter meeting, was the first of its kind in over 15 years. The excellent exhibits and large attendance both set a good pace for future electrical expositions.

Considerable space was devoted to new insulating material and methods of applying it. Instruments also took an important place, with special attention to insulation testers, cathode-ray oscilloscopes and a variety of laboratory and portable instruments. Latest developments in transmission equipment placed emphasis on cable connectors, high-tension fuses and switches. Several types of motor control and distribution apparatus were shown, also motors, transformers and welders.

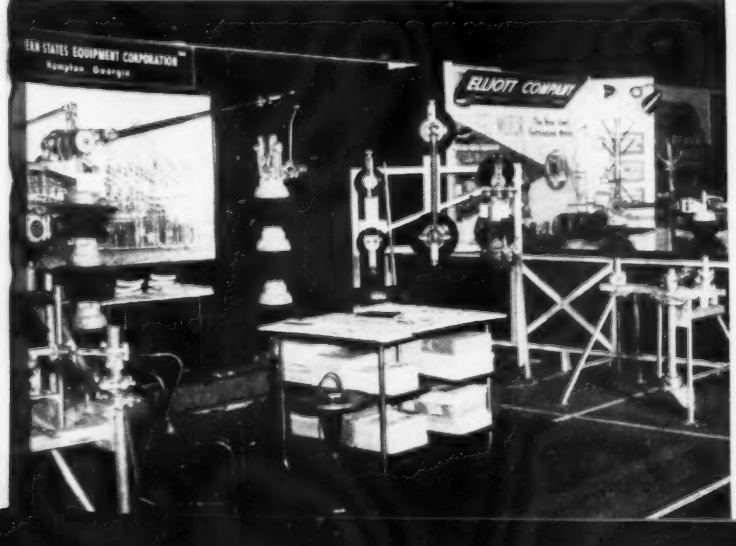


Silicone resins used with fibrous glass and asbestos give a new insulating material that is unaffected by heat. Thus electric motors and transformers in chemical plants, steel mills, mines and diesel locomotives last longer and work harder than ever before

Experimental transformers insulated with silicones under U. S. Navy sponsorship show improvements over standard units. Transformers (left of circle) have class A insulation while those at right, which have silicone insulation, are smaller in size for same or higher ratings. They also have 150-C rise while class A transformers have 50-C rise

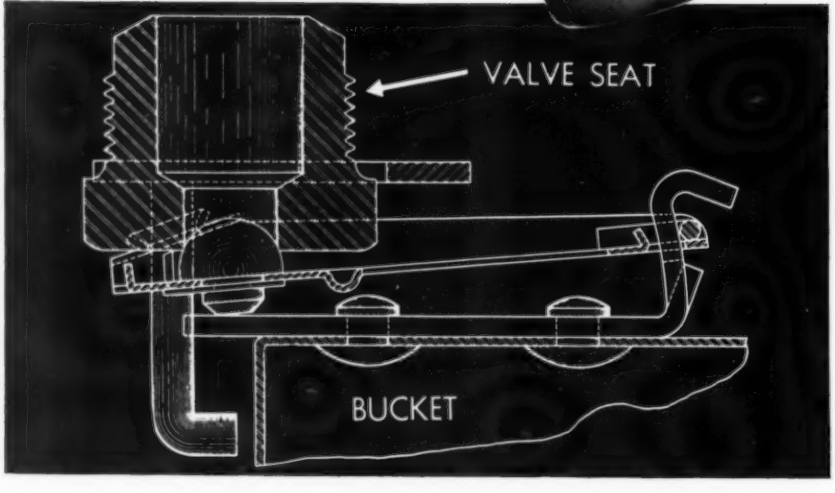
Temperature and moisture resistance as well as high dielectric strength are some Fiberglas characteristics that make it an excellent electrical insulator. These same properties provide a good inorganic base for many types of insulating varnishes and resins

Exhibit below shows large variety of meters and instruments now available for checking and testing electrical equipment in the laboratory and in field service



High-voltage and high-current disconnect switches, as well as medium voltage drop-out and automatic reclosing fuses, are part of this modern switching-equipment display. Elliott Co exhibits steel-fabricated motors (left)

Superiority in



THE *Free Floating* VALVE

Armstrong pioneered this exclusive* valve mechanism which uses no fixed pivots. The hemispherical ball valve is fastened near one end of the free-floating stainless steel valve lever. This lever is guided by two vertical pins which fit loosely in ears extending from the sides of the valve lever. In closing, the hemispherical valve is lifted directly to the orifice by the buoyancy of the trap bucket.

When the bucket fills with water and sinks, it pulls down on the end of the valve lever. As the lever moves, the knife-edge fulcrums bear against the face of the valve seat and through high leverage the valve is pulled directly away from the orifice.

*Patented.

SELF-SCRUBBING. Every Armstrong steam trap is *self-scrubbing*—thanks to action of incoming water swirling under bottom of inverted bucket and carrying dirt and scale along with condensate. Large valve orifice and simple free-floating valve mechanism makes trap highly immune to ordinary dirt troubles.

NO STEAM LOSS. The Armstrong trap is suitable for variable load conditions and no steam passes through the discharge orifice even when there is no condensate load.

AUTOMATIC AIR ELIMINATION. Any air entering the trap ahead of condensate or coming in with the steam passes through the small vent in the top of the inverted bucket. This air collects at the top of the trap and is discharged ahead of the condensate when the valve opens.

Removal of air from heating units is fully as important as the removal of condensate. Air dilutes the steam, reduces its temperature, and reduces heat transfer rates.

BIG CAPACITY. The unique leverage principle employed in the Armstrong *free-floating* valve mechanism permits use of larger discharge orifices than would otherwise be possible. This means that you get big capacity in a small size trap!

STAINLESS STEEL TRIM. All parts of the Armstrong trap operating mechanism, including the valve seat and inverted bucket, are stainless. Similar high standards for quality are maintained for other parts. *Superiority in design and construction means lower maintenance costs — better performance!*

ARMSTRONG
MACHINE WORKS
812 Maple St.
Three Rivers, Mich.

ARMSTRONG · "INVERTED BUCKET" STEAM TRAP ·

ARMSTRONG

DESIGN *and* CONSTRUCTION *means*

LOWER MAINTENANCE COSTS!

Mr. Jos. Spiegle, plant engineer at Eastern Box Co., Baltimore, Md. (picture at right), has had his plant 100% Armstrong equipped since 1936. As compared with previous traps, he figures that Armstrongs have cut his maintenance costs 80%.

PACIFIC NUT OIL COMPANY

Producers of Vegetable and Nut Oils and Meals

4615 BANDINI BOULEVARD
LOS ANGELES, CALIFORNIA

MAILING ADDRESS
P. O. BOX 99 STATION "C"
LOS ANGELES 11, CALIFORNIA

April 25, 1946

Guy L. Warden,
209 West 12th St.,
Los Angeles (15), Calif.

Gentlemen: Attention: Mr. John Ward

We have just completed making an analysis of the savings realized by the installation of Armstrong Steam Traps on fifteen Anderson Expeller Tempering Troughs, and thought you would be interested in the results of same:

The Steam Traps were installed during the last week in February; we therefore made a comparison of the month of February with the first 28 days of the month of March, with the following results:

Fuel Consumption	---	30.00% less
Water Consumption	---	65.00% less
Extraction of Oil from material being crushed	---	0.50% more

At the time of installing the Steam Traps, we also increased the size of the tempering troughs from five-foot to ten-foot, thus making the above savings all the more remarkable.

Truly yours,

PACIFIC NUT OIL COMPANY

W. D. Horne

W. D. Horne, Superintendent

BETTER PERFORMANCE!

STEAM TRAPS

Fig. 1—Cars dump coal not immediately needed into an open pit; overhead crane deposits it in adjacent area

Fig. 2—Rubber-tired scraper unit loads coal from the open area and hauls it 600 to 700 ft to the stockpile

Fig. 3—On the 4-acre stockpile, the rig spreads coal in layers 4 to 6 in. deep, compacting at the same time

Fig. 4—When stored coal is needed, high-speed scraper loads coal from the stockpile and hauls it to the plant

Scraper Equipment Stockpiles Coal for Utility

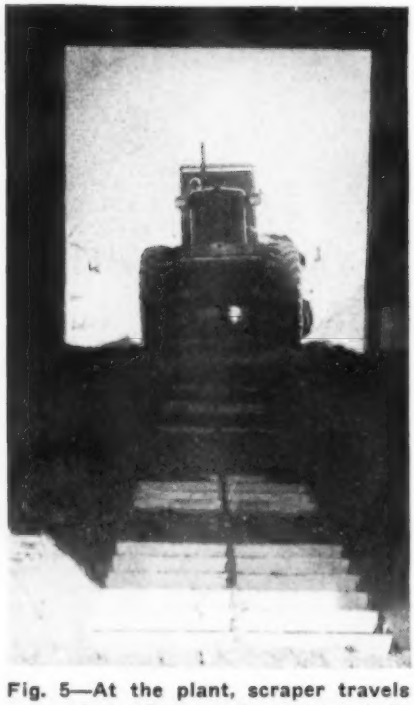


Fig. 5—At the plant, scraper travels over grizzly, dumps onto conveyor belt. Incoming coal cars normally dump here

▶ SERVING APPROXIMATELY a million residents in the highly developed industrial area of Indianapolis and Marion County, Indiana, the Indianapolis Power & Light Co must maintain uninterrupted service. This requires stockpiling a 90-day supply of coal at the Harding Street Station. Additional coal is also stored at this location for the Perry Section K Station, located in another part of the city.

Bottom-dump railroad cars bring coal to Harding Street. Normally, the cars run over a grizzly and dump onto a conveyor belt, which carries coal into the plant for daily use. Coal not immediately needed is dumped into an open pit. An overhead clamshell picks it up and deposits it in a nearby area.

Coal for the stockpile is loaded at this point by two scraper units—a rubber-tired Tournapull and a tractor-drawn Garwood scraper—and hauled 600 to 700 ft to a 4-acre stockpile. These rigs spread the coal in thin layers, 4 to 6 in. thick. Layer-piling, plus the compacting action of the scraper equipment, helps to eliminate danger of the coal overheating in the stockpile.

On this operation, the Tournapull-Carryall scraper combination delivers an average of 142 tons per hour to the stockpile; it has moved up to 200 tons during peak hours.

In the event of an interruption to normal coal supply, the Tournapull is used to reclaim from the stockpile. It hauls coal directly to the grizzly, dumping it on the conveyor belt going into the plant, onto which incoming coal cars normally discharge. By this same method, coal is delivered to Indianapolis Power & Light Co's Perry Section K Station, if operations so require.

TAX REVISION...

Can Make or Break American Business

IS THE American way of life—progress by private initiative—going to get a fair chance to demonstrate its superiority over all the challenging varieties of collectivism?

That's the real question before Congress as it confronts the long labor of remodeling the federal tax structure. What Congress does about taxes will come pretty close to making or breaking the U. S. A.

Today the tax colossus that sprawls across the national economy is unguided by any central nervous system. Its crushing weight comes down first here, then there, as the giant wobbles around, unguided by any central purpose except to grab as much as it can.

The central purpose of a tax system is simple. It should raise the necessary revenue without placing unnecessary fetters on enterprise.

As recently as 1929 federal taxes took only one dollar out of every twenty of national income. A loose-jointed and inconsistent tax structure was a nuisance then. But it wasn't serious.

Today the federal tax burden is the dominant element in the nation's economy.

Even if Congress succeeds in cutting $6 billions out of President Truman's $37.5 billion budget, federal taxes still will take about one dollar out of every five of the national income. And few Congressmen are hopeful enough to think that they can get the tax load below $25 billion for any year that is in sight.

Drastic Budget Cuts Required

Indeed, to get the tax load down to $25 billion, Congress will have to stop treating expenditures, like those for military purposes and veterans, as politically sacrosanct. Congress must scrutinize *every* item in the budget. Economy must go along with tax cutting or we shall end in bankruptcy.

Suppose that expenditures are slashed to the bone. Our taxes *still* will be so heavy that the *way* they are loaded on the nation's back will make a big difference in how well the nation gets along. That's something which the postwar boom has tended to obscure. It will become much clearer as this boom wears off. Then a remodeling of the federal tax system to remove its manifold obstructions to private enterprise will be of transcendent and obvious importance to everybody.

Tax Experts Agree

The remodeling will require political courage plus tax wisdom. Congress must supply its own political courage. But it can lean on tax experts for tax wisdom. Fortunately, tax experts now agree on the necessary reforms—especially on those that will remove obstructions to business. How well the tax experts agree is shown in the charts on the next page, summarizing answers to a questionnaire on possible federal tax reforms. The questions were asked by the Department of Economics of the McGraw-Hill Publishing Company. The answers came from a broad cross-section of tax experts, including the authors of a considerable crop of books on postwar federal taxes and what to do about them.

The experts agree (see the charts) that double taxation of corporate dividends should stop.

They agree that the tax rate on corporate income (now 38 percent) should be reduced as rapidly as possible to the initial rate on individual income (now 20 percent).

And they agree overwhelmingly that it is desirable to let net losses be subtracted from net profits over a 5-to-6-year period in computing business income for tax purposes.

All three changes would stimulate corporate initiative and hence make jobs. Averaging business incomes would make new ventures attractive even though these ventures *might* result in early losses. Reduction of the corporate income tax would have the same effect. So, too, would the elimination of that highly discriminatory provision whereby corporate dividends are taxed first as corporate profits, and again when received as income by individuals.

Penalties on Incentives

Beyond these changes, there must be an end to tax penalties on *individual* initiative. Consider the enterprising business man whose income fluctuates markedly from year to year. Because of his enterprise he may pay, on the same income, twice as much federal income tax as the man who plays it safe for a steady income. That's because he can't average his personal income over several years for tax purposes. He can count on heavy taxation of his good-year profits with no chance for offsetting against them his bad-year losses. It is a case of heads you lose, tails the tax collector wins. Eighty-six percent of the experts agree that an income-averaging allowance for individuals is desirable.

Three-quarters of them also agree that tax rates at the top end of the individual income scale (now running up almost to 90 percent) should come down. In my judgment, the total tax should not amount to more than 50 percent to encourage business men to venture for high stakes.

Advocating tax relief for men in the higher income brackets—and particularly for management men—has been considered political suicide for more than a decade. Some members of Congress still hold that view. A Democratic Congressman from Michigan told an Illinois colleague who advocated cutting upper bracket taxes, "If you put that idea forward at home, you won't come back."

The Congressman has an even better chance of not going back if our economy bogs down. One of the best ways to bog it down is to keep the taxes that destroy business incentives and block enterprise—for example, the confiscatory rates which drive the people in the high brackets away from risk-taking.

To give the American system of individual enterprise a fair chance was clearly the mandate of November's election. To give it that chance, enterprising business men must have a chance to make large rewards—as well as the always-present chance to lose their shirts. Under present tax rates, they don't get a break.

Prevailing federal taxation throttles bold business enterprise in other ways. It fails, for example, to encourage research and rapid industrial modernization. It tends to siphon investment away from private enterprise, driving it into tax exempt state and local securities. (The experts agree almost to a man that such tax exemption must be eliminated.) The list of obstacles could be amplified.

Hit-and-Run Revision Disastrous

Most of the reforms needed to prevent the federal tax system from smothering enterprise would lower federal revenues, at least temporarily. Elimination of the double taxation of corporate dividends might lop off $800 million. Dropping the corporate income tax from 38 percent to 20 percent might cut away as much as $4 billion.

Because we can not avoid enormous federal expenses in the years immediately ahead, all badly needed reforms of the type to which this article is confined obviously can't be made at once. Also there are other tax reforms bearing on consumption which obviously should be weighted in an over-all program of tax revision.

But this is equally obvious: We should have a general design for tax revision which would line up all the necessary steps. Then we could get ahead with tax reductions as rapidly—and as sensibly—as revenue requirements and political courage would permit. Tax cutting may come piece-meal, but tax planning must not.

Through such a design we might discover that some decidedly beneficial improvements in the federal tax structure can be made at relatively slight cost. But today there's no way to be sure. No one in Washington with access to the information has even undertaken to make the necessary estimate.

Instead, federal tax revision continues to be a hit-and-run business—and a short-run political business. Take, for example, the proposal of a 20 percent tax reduction across the boards. There are virtues in such a proposal. But how they stack up beside many other extremely urgent needs for tax reform remains a mystery.

Congress must dispel such mysteries. Only in that way will it do the job of converting our present jerry-built tax structure into a moderately safe abode for the American system of private initiative, sparked by adequate incentives.

EXPERT OPINION ABOUT TAX REVISION

TAX EXPERTS THINK WE SHOULD:	% Of Tax Experts Favoring the Proposed Changes
1 ***Eliminate double taxation of corporation dividends*** which are now taxed as corporate profit and then again as individual income.	92%
2 ***Reduce corporation income tax rate (now 38%)*** as rapidly as budget needs permit until it equals the initial rate for individual incomes (now 20%).	73%
3 ***Provide for averaging business' taxable incomes*** over a period of about 6 years to allow for losses in bad years.	97%
4 ***Provide for averaging individuals' taxable incomes*** over a period of a few years so as to treat fairly those whose incomes fluctuate.	86%
5 ***Reduce upper bracket individual income tax rates*** to a maximum of 50% in the $100,000 bracket and 75% in the million and over bracket.	76%
6 ***Treat capital gains, now taxed at a lower rate,*** like other income but provide full allowances for losses.	64%
7 ***Remove the privilege of tax exemption*** from all future issues of state and local government bonds.	92%

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

THIS IS THE 56TH OF A SERIES

Australia Gets First Topping Unit: Plans 10-Year Power Development

► MELBOURNE (*McGraw-Hill World News*): With the announcement of the introduction of superposition as a new power-plant technique and of a 10-year program of development for the State of Victoria, Australia takes a major step in postwar industrialization.

The topping unit, installed at Balmain power plant of the Electric Light & Power Supply Corp, operates at 1200 psi and 900 F, exhausting to 225-psi 700-F machines. The resulting heat rate is 14,500 Btu per kwhr, which compares with 19,500 before superposition. Balmain plant burns a mixture of coal and coke breeze in varying ratios, which makes comparisons, on a basis of lb of coal per kwhr, difficult. If 12,500 Btu per lb is taken as the average heat value, consumption per kwhr has been reduced from 1.56 to 1.16 lb.

In the effort to keep up Victoria's end in the race with New South Wales for compact settlement and new industrial capital, the State Electricity Commission has mapped a 10-year program to expand Victoria's over-all generating capacity from 409,715 to 717,715 kw. (For a review of Australia's general power situation and prospects, see POWER, Nov 1944, pp 746-749.)

Principal element in these plans to meet the state's growing power demands will be an extension to make the brown-coal-fueled 175,000-kw Yallourn station the largest steam-power installation in Australia. Expansion envisaged represents an increase of about 75% in generating capacity to a total of 300,000 kw. Bids are now being asked for two 50,000-kw machines to replace two of six existing 12,500-kw units.

BROWN COAL STRIP-MINED

As previously described in POWER (Sept 1944, pp 605-608), the Yallourn boilers operate on brown coal, which is excavated at the rate of 20,000 tons per day in an open-cut mine immediately adjacent to the plant. The fuel as it comes from the mine carries about 65% moisture and has a heating value of only 3000 Btu per lb. Drying equipment integral with the boilers makes it possible to burn this coal on step and traveling grates with good efficiency.

About one third of the brown coal mined goes to a briquetting factory where processing brings the heating value up to about 9500 Btu per lb. Some smaller steam power plants operate on these briquettes exclusively.

Victoria's power program also provides for addition of 60,000 kw at Newport C station, now rated at 138,000 kw including a new 30,000-kw turbine-generator undergoing tests. Two more sets of the same capacity are expected from England in 1948. Newport C also burns briquettes.

The balance of the power expansion will be in hydro developments. Substantial progress has been made in the second stage of the Kiewa project, construction of the main storage reservoirs being complete. There will be four power stations: No. 1 (21,000 kw) at an elevation of 4000 ft, No. 2 (33,000 kw) at 3700 ft, and No. 3, now completed (24,000 kw) at 1840 ft. The lowest, No. 4, will be underground to secure the last unit of power from the water before its discharge at the 1200-ft level into the river near Tawonga. Its capacity will be 39,000 kw. A feature of plants No. 1, 2 and 3 will be rock tunnels in place of open water races. Three generators for the No. 2 plant are expected to be in operation in 1948.

The development program calls for installation of 93,000 additional kw at Kiewa and a corresponding enlargement of the upper storages on the Bogong High Plains. Designs are also being prepared for a power station of three 21,000-kw units at the Hume Weir in New South Wales, and an agreement is being sought on the utilization of the Hume within New South Wales.

General view of Yallourn station with intake tunnels in foreground and open-cut brown-coal mine in background

Twenty Men Equal One Horse, Says C M Ripley

At pumping or sawing a man can do 1,188,000 ftlb of work in 10 hr. This is equivalent to ½ kwhr. The man averages about 45 watts per hr

Lifting 65 tons up 4 ft in 6 hr equals 520,000 ftlb. This day's work is about equal to 1/5 kwhr. A man averages only 33 watts per hr

Laborers in China working on a tread mill average about 31 watts per hr as a full day's work. Note relatively short lift and small stream three men produce

► Said Henry Ford: "This is not a machine age, it is a power age. The machine is merely the instrument which makes power available for production." I agree with that!

Encyclopedia Britannica states the accepted unit of power is the horsepower, which was defined by James Watt as 33,000 ftlb of work per minute. This is about ten times as much work as can be done in a minute by a laborer working eight hours per day.

In my opinion this statement is perhaps one of the most widespread engineering fallacies. Not only business men and college boys, but even engineers have believed for a century that a man can do one-tenth horsepower.

They think a laborer can exert 0.1 of a horsepower (75 watts) and keep it up for 8 hours! He can do only half that!

Charles P Steinmetz, the well-known electrical wizard, wrote that at the average job a strong man can exert only 33 watts throughout a working day. When I protested to him with the assertion that we have believed for generations that a man is good for one tenth of a horsepower, or 75 watts, he pointed out:

"It takes 22½ men to equal a horsepower all day. At some jobs man is able to exert even less than 15 watts. Take shoveling, for instance. Here a man must use the small muscles of his fingers, and they get tired sooner than

Hammering all day a man does 480,000 ftlb of work in 8 hr. A day's work at this job results in only 1/6 kwhr, an average of 23 watts per hr

Carrying 16.7 tons up 12 ft in a hod equals 400,800 ftlb of useful work in 6 hr. This equals about 1/7 kwhr for a day, which is 25 watts per hr

Wheeling 51 tons up 3 ft is equivalent to 306,000 ftlb of work in 10 hr. This day's work equals only 1/8 kwhr, or average of only 12 watts

the larger muscles of his arms and legs. Get Kent's *Handbook* and look at the table giving actual measurements of how many foot-pounds of work were done by a workman in a day on several different jobs.

So I checked up on Steinmetz' statement. The table is listed under "Animal Power" in the 10th edition of Kent's *Mechanical Engineers' Handbook.*

The table showed ten different conditions under "Kind of Exertion." Of all these exertions, measured by Rankine, man makes his biggest output, 2,059,200 ftlb in a day, by walking up and down stairs empty-handed.

As Steinmetz mentioned, shoveling has the most pathetic manpower record of all, only 280,800 footpounds of useful work done in a day. This is about *one ninth* of the work done in climbing stairs for eight hours. The results of several different jobs based on Rankine's figures are shown in the illustrations.

Now you'll note Steinmetz expressed a man's power in watts. That was the first time I had ever heard that done. So I followed his example and changed manpower to watts.

The watts, exerted in nine jobs measured by Rankine, average only 35 watts throughout the day. How puny man is! That is less output than the little fan above the electric stove in my kitchen!

Shoveling 25 tons of loose dirt up 5 ft equals 250,000 ftlb in 10 hr. This strenuous day's work is only 1/9 kwhr, about 10 watts per hr

RESULTS OF WORK DONE AT DIFFERENT JOBS

Kind of job	Weight or resistance	Velocity of work	Hours worked	Ft lb	Kwhr	Average watt hr
2 men lifting water 5 ft raised 116 tons, or 27,800 gal	17.6	22 baskets per min	10	580,000	0.44	22
1 man lifting water 5½ ft raised 104 tons, or 24,900 gal	36.2 lb	8 buckets per min	12	1,130,000	0.42	35
2 men, taking turns, pulled canal boat 17 miles	23.6 lb	150 fpm	10	1,062,000	0.40	40
1 man carrying bricks up 6 ft carried 12 tons	200 lb	20 loads per hr	10	240,000	0.09	9
1 man (in the U. S.) carrying bricks up a ladder 17 ft raised 6 tons	68 lb	22 loads per hr	8	203,458	0.08	10

Measurements made in China by Professor P I Wold, of Union College, Schenectady, N. Y.

Rankine made his measurements in Scotland. Professor P I Wold, of Union College, Schenectady, N. Y., measured the power of laborers in China. (See table, left, and photo on opposite page.) His figures average 31 watts as a strong man's power all day.

Rankine's man averages 35 watts, and Wold's, from the other side of the world, averages 31. So Steinmetz with his 33 watts was about right.

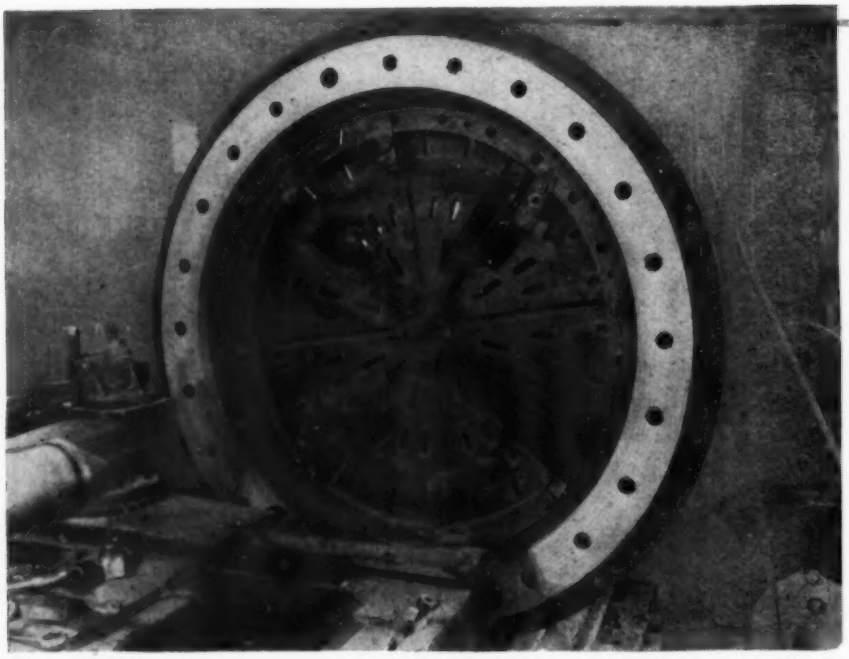


Fig. 1—Both ring faces were machined off 0.04 in. and grooved as in Fig. 2. Sprayed metal has been applied and the ring is now ready for finish machining

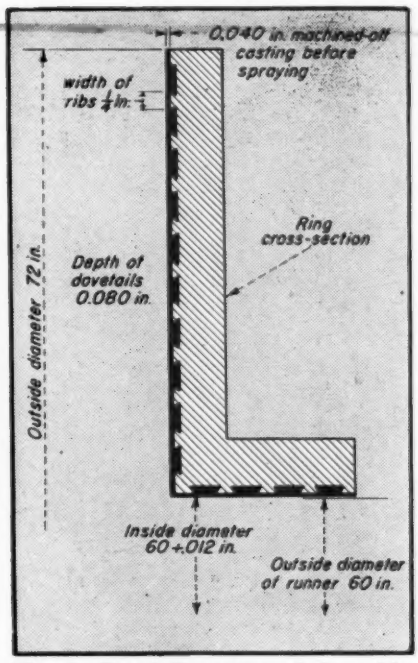

0.040 in. machined-off casting before spraying
width of ribs ¼ in.
Ring cross-section
Depth of dovetails 0.080 in.
Outside diameter 72 in.
Inside diameter 60 +.012 in.
Outside diameter of runner 60 in.

Fig. 2—Dovetail grooves 1 in. wide, 0.08 in. deep were cut in the faces

Metal Spray Restores Original Efficiency of Turbine Seal Rings

F Britt, Northern Engineering & Supply Co, Ltd, explains how his company built up the seal rings* in the hydraulic turbines of the Kaministiquia Power Co. In operation almost a year, areas sprayed with metal are expected to stand up in service

▶ THE BRONZE RINGS act as a seal between the hydraulic-turbine runner and scroll case. Clearance at this point is of major importance; a wide gap bypasses considerable water, which lowers the turbine efficiency. For best economy the difference between outside diameter of turbine runner and inside diameter of seal rings is held within 0.030 in. to minimize water leakage.

Measuring Clearance. Because the powerhouse shop was not equipped with a large lathe it was necessary to transport the rings 18 miles to our shops. Outside diameter of the turbine runners was measured very carefully at a temperature comparable to that in our shop. The rings have an angle cross-section shape with a face 6 in. wide, and throat 2.5 in. deep. Metal thickness is one inch. Over-all inside diameter is 5 ft, and outside 6 ft. Capscrews fasten each ring to its cast-steel housing, which in turn is bolted to the scroll case. Unusual shape of the ring and housing required special spacers for attaching it to the faceplate, Fig. 1.

Spraying the Metal. A previous attempt had been made to smooth off the rings by applying tin or solder with a blow torch. The soft metal had penetrated fairly deep into the honeycombed surface making it necessary to take a deep cut to face the rings to a clean bronze surface. After considerable discussion as to the best method of locking the sprayed metal we decided to cut dovetail grooves in both faces, Fig. 2. After machine work was completed the entire surface was fusebonded. A total of 568 lb of bronze was sprayed on the four rings.

Other Sprayed-Metal Uses. During the outage, sprayed metal was also used to (1) build up the steel vane shafts, which were worn about $\frac{3}{32}$-in. undersize in diameter (2) reform the contour of bucket corners on the waterwheels. Usual method of threading and knurling was used on the vane shafts. For convenience in chipping and grinding the honeycombed areas on the waterwheels, they were moved just outside the draft tubes. Chipped area was fusebonded to prepare the surface before the metal was applied. This method was used to provide a good bond.

The units were returned to service about Jan 1, 1946, and have been in continuous operation. There is no visible way of determining how the sprayed-metal areas will stand up in service until the units come out for inspection, but we believe the results will be found satisfactory in all respects.

* From the October 1946 issue of Metro News.

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Avoid Explosive Hazards in Feedwater Heaters

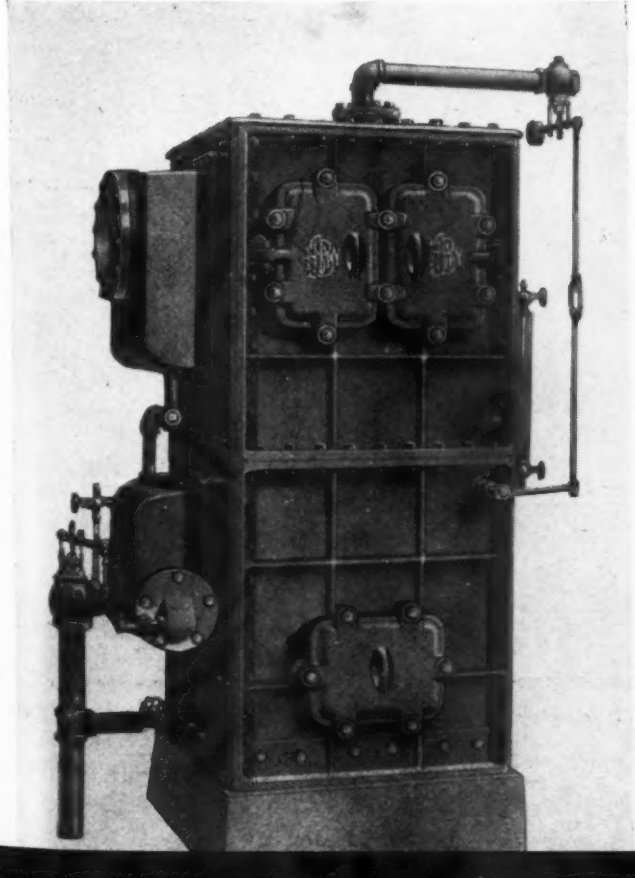
Harry M Spring discusses possible explosion causes hidden in feedwater heaters. Chief dangers are failures from improper use (mostly of second hand equipment), corrosive weakening, incorrect overpressure appliances, development of water hammer, in addition to structural defects

▶ BECAUSE FEEDWATER HEATERS usually operate at low pressure many power engineers believe that little danger exists, and consequently are inclined to overlook the hazards in these heaters. Here is an example that should dispel any such false impression. A typical rectangular heater, 5x6 ft, under 10-psi internal pressure has a total pressure of 43,200 lb and, with water over 212 F, tremendous potential energy. Rupture of a vessel holding 1125 gal of boiling water at 10 psi releases by explosion as much energy as 25 lb of nitroglycerine.

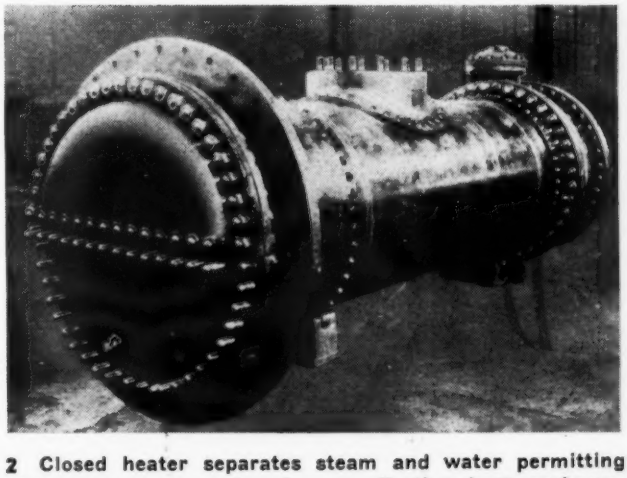
Before discussing specific operating hazards, let's look at the three basic heater types found in present-day power plants. This look will be a short discussion of their operating theory.

Open Heater. First and possibly oldest, the open or direct-contact heater, Fig. 1, normally operates vented to atmosphere, or sometimes under about 5 to 10 psi of steam. It frequently draws heat from the exhaust of reciprocating-steam equipment, and with direct contact of steam and water, contamination of boiler feed may result from use of impure steam. Chief operating advantage of the open heater is reduction in the corrosive tendencies of water by removal of dissolved or entrained oxygen.

Closed Heater. Fig. 2 shows a closed or indirect heater where steam does not come in direct contact with feedwater. Inside the shell, the steam, at pressures from 2 to 3 psi up to 400 psi or higher, surrounds the tubes through which the feedwater flows. This design lends itself to high-pressure operation and serves as a heat exchanger. It does not, however, aid in expelling



1 Open or direct-contact heater operates at atmospheric pressure, or 5-10 psi above. It helps remove dissolved oxygen

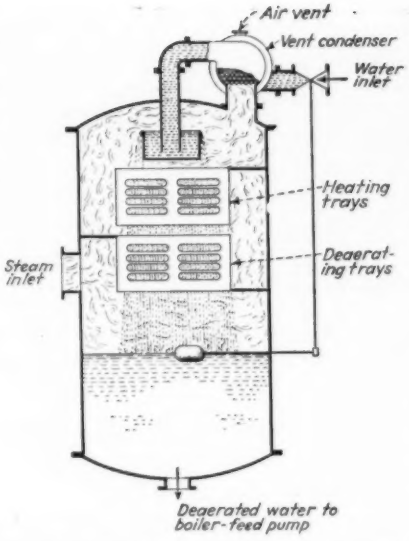


2 Closed heater separates steam and water permitting high pressure operation for an effective heat exchange

any of the oxygen that is dissolved.

Deaerating Heater. An adaptation of the open heater, the deaerating heater in Fig. 3, is a direct-contact heater that operates at pressures as high as 75 psi or more. Noncondensable gas passes through the vent condenser, at the top of Fig. 3. The deaerating heater with its positive operating pressure, plus a moderate static-suction head, overcomes an objection often leveled at the older low-pressure open heaters, that is, a small or, too often, nonexistent positive suction head on the feed pumps. In addition, this high operating pressure on the deaerator increases the effective removal of dissolved gas, and aids in precipitating certain scale-forming materials.

Large boiler plants frequently tie deaerating and closed feedwater heaters in a regenerative-cascade hookup, Fig. 4, to reap the definite operating advantages of both types.



3 Deaerating heater helps to remove the oxygen from water under pressure

OPERATING HAZARDS

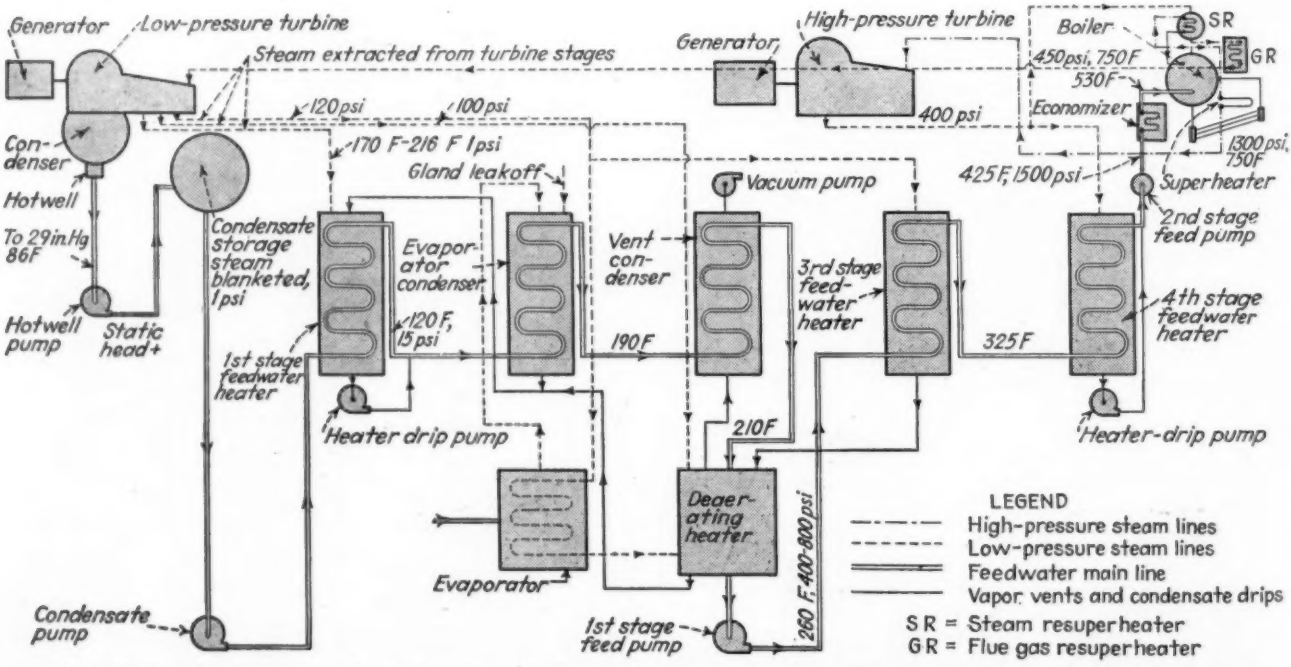
Design Failures. With the modern feedwater heater, failures directly traceable to faulty design are few and far between. When ordering, the user should specify a maximum operating pressure along with other pertinent data. Some states require ASME design, construction and stamping if heaters are to operate at substantial pressures. A few localities have their own special regulations, so it is well to investigate before approving specifications. In the absence of local requirements, ASME stamping assures quality design and construction.

Second-hand equipment figures predominantly in failures of feedwater heaters where design has been held substandard for operating conditions. Since many designs, such as castings of variable section or those reinforced with ribs, do not lend themselves to ready calculation of pressure or stresses, it is well to be wary of obsolete or second-hand pressure vessels for modern plant operation. Before purchase, a qualified boiler inspector, familiar with plant requirements, should inspect any second-hand heater. Frequently a hydrostatic test up to one and a half or two times desired working pressure is advisable as a test for reliability.

Overpressure Appliances. First and most important protective appliance is the safety valve. Often open feedwater heaters receive exhaust steam through 8- to 12-in. pipes. An atmospheric relief valve, set at 5 to 8 psi and installed on the exhaust piping between engine and heater, serves usually as the safety valve. It is customary, also, to provide a live-steam makeup line that enables the heater to operate when the engine is shut down. This live-steam line should pass through a pressure-reducing valve set within the maximum safe pressure of the heater. An ASME standard pop safety valve, equipped with a test lever and set at not over the maximum allowable pressure on the heater, should always follow the pressure-reducing valve. This pop safety valve may be on the steam line between the reducing valve and the heater or, preferably, on the heater itself. It should not be smaller than the incoming live-steam line.

Explosions have developed in feedwater heaters with defective pressure-reducing valves, and in some with no pressure-reducing valves at all. With no pressure-reducing valve, or where one is by-passed, primary pressure reaches directly to the heater. Hazard from this cause is eliminated by installing a proper pop safety valve.

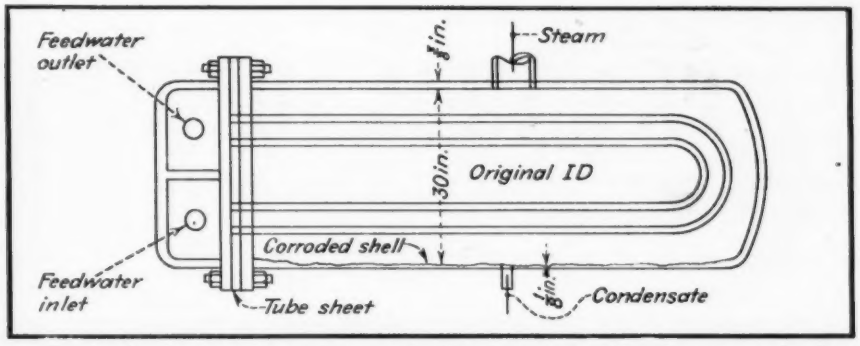
Another cause of overpressure may result from too high a vent or escape pipe from the pop safety valve, or atmos-



4 A typical regeneration cycle used in large boiler plants to employ both the deaerating and the closed heaters

Vent-pipe discharge at roof
140 ft
Install tee and full-sized overflow (no valves) no higher than this point to limit pressure in heater to 15 psi
34 ft - 6 in.
Open heater
Resultant static pressure with flooded system - 60.7 psi

5 A too-high vent or escape line causes excessive pressure to develop



6 Feedwater heater above shows reduction in cross-sectional area, weakening the shell, as the direct result of corrosive action on an unprotected metal

pheric-relief valve. Fig. 5 shows an installation where flooding may fill the vent lines and cause excessive pressure to develop in the body of the feedwater heater.

Corrosive Weakening. Progressive corrosion of either inner or outer surfaces may weaken a feedwater heater to the danger point. Usual feedwater-heater design calls for a basic factor of safety from 4 to 12, and an additional thickness for corrosion allowance is good practice. Corrosion-resistant material used in the fabrication of the shell provides an alternative to an adequate corrosion allowance. Fig. 6 illustrates the weakening effect of a corroded heater shell.

Water-Hammer Failures. Commonest cause of failure in feedwater heaters is water hammer. It occurs usually when the heater is waterlogged—that is, filled to the top with water because of a defective overflow or other reason. Unfortunately the spring-loaded safety valve, designed for relief of pressure due to steam, has too much inertia to respond to the almost instantaneous pressure wave of water hammer. If by some chance it should open, relief of pressure would be inadequate.

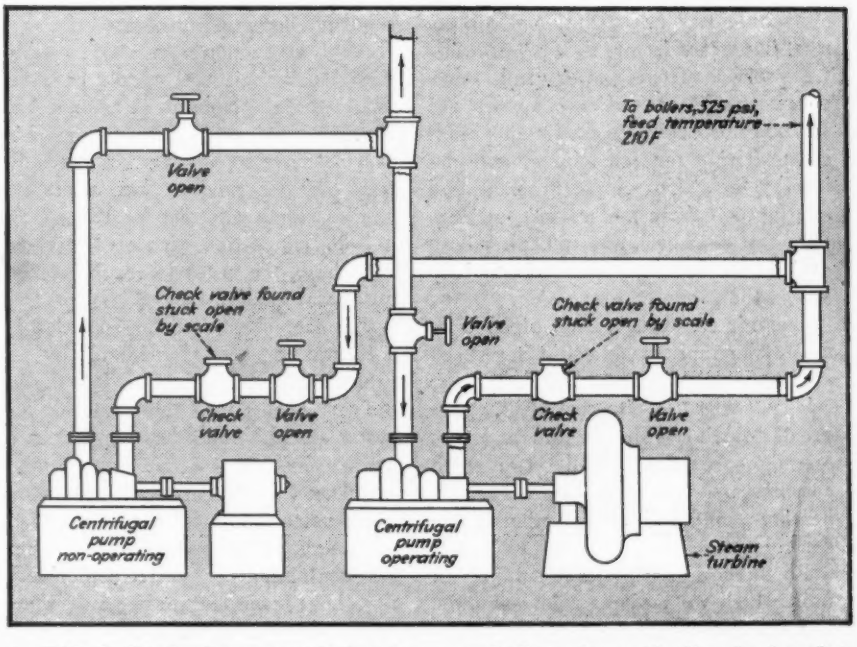
Best prevention of this hazard comes from removal of its source. Overflows and their controls should be kept in first-class condition. If, despite this precaution, a heater becomes waterlogged, accidents may be prevented by closely observing the rule of always opening valves slowly. The following serious explosion occurred from failure to observe this rule. Live-steam makeup supplied by remote-controlled solenoid valves entered an open heater. The operator opened these valves to admit condensate, followed immediately by live steam. This flow entered at a rate greater than the capacity of the overflow and the safety valves with the inevitable result of a shattering explosion.

A second possible danger spot, and one vital to safe operation, is the check valve in discharge lines of centrifugal feed pumps.

Fig. 7 shows a piping diagram of a feedwater heater that suffered an explosion from a defective check valve. Investigation suggested that the heater became subjected to high temperature—high-pressure water either from the boiler feed pump or the boiler itself at the moment of shutting down one of the two centrifugal feed pumps. Preventive measures for such an accident constitute periodic inspection and maintenance of all check valves in the feedwater system.

Defects Cause Failure. At the head of any list of failures due to defects appear cracks. They include casting cracks, resulting from shrinkage or other foundry shortcomings, such as sand holes. Other cracks may well be shock-produced by water hammer, and not pronounced enough to be apparent at the time of shock.

Another defect that leads to failure is leakage. Leakage past bolted doors or flanges wastes away the bolts. When it appears, steps should be taken to remedy it and repair any evident damage, especially to pressure surfaces.



7 This boiler-feed-pump cycle led to an explosion when a faulty check valve fed high-pressure and high-temperature boiler feedwater direct to the heater

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men

COMPRESSED AIR DOES CLEANING JOB

WE CONSIDER CLEANLINESS one of the most important factors in 100% trouble-free service from power and other equipment. Many of our motors are wound-rotor design in continuous operation, driving fans on an air-conditioning system. To clean brushes and sliprings on these motors without stopping the machines was difficult so we decided to use compressed air to help out on the job.

This air could have been piped from a central supply or we could have used a portable compressor. The latter was selected because it cost less, gave greater flexibility in its use, and also served as standby for the two small compressors that supply air for the heating- and air-conditioning-system controls.

Photo shows the portable compressor unit, which we assembled in our shop. We had the air receiver, which is designed for 250 psi, but purchased second-hand the one-hp 1750-rpm 120-v repulsion-induction motor and the small vertical air compressor. We installed these on a hardwood-plank base and mounted the assembly on four ball-bearing casters to make the machine easy to move to any part of the building. The air receiver has a pressure gage, a safety valve set for 125 psi, and a ½-in. connection with a valve for 50 ft of hose, the latter to reach into out-of-the-way places.

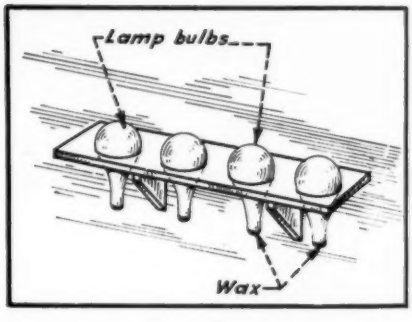
The motor connects to an extension cord and can be plugged into any convenient 120-v wall outlet for driving the compressor. For blowing dust out of motor starters and other dry places we use an insulated nozzle on the hose. To clean motor brushes, sliprings and other parts where oil may be present, we connect the hose to a hand spray gun containing carbon tetrachloride. A few shots from the spray gun removes every trace of dust and dirt from motor brushes and sliprings. This compressed-air equipment has proved one of our most useful maintenance tools and an important factor in keeping equipment in good condition.

New York, N. Y. FRANK RUDOLPH

LAMP BULBS MAKE FIRE EXTINGUISHERS

WE HAVE VARIOUS TYPES of plant fire-fighting equipment, but felt we needed something we could apply quickly and in small quantities. So we developed what might be called fire-extinguishing bombs. These are made from old 100- to 200-watt incandescent lamps filled with carbon tetrachloride, and seal-closed with hard wax.

We remove the base from the lamps, and then with a pair of pliers break loose the center in the bulb's end. Often this permits removing the fila-

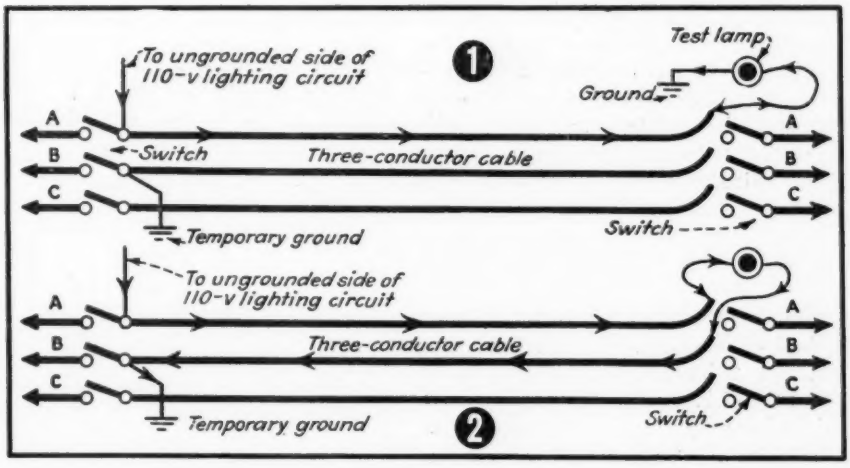


ment-supporting post inside the bulb. If this post does not come out easily, however, we leave it loose inside the bulb. What we need is a hole large enough to pour in carbon tetrachloride. After the bulbs are filled sealing wax is softened and pressed into the open base. Then with a small flame the wax is heated to flow on the glass and make a liquid-tight joint.

The filled bulbs are supported in groups of about four on brackets around the plant, as in the figure, where they can be readily used. One or more of these bombs tossed into an inclosure on a fire will quickly extinguish it. These bombs lack certain desirable features in fire-fighting equipment, but they do not require care and are always ready for service.

Philadelphia, Pa. C R CUMMINGS

TEST FOR CORRECT PHASE RELATION



When identifying conductors in long 3-phase circuits, test procedure is simplified if the work can be completed at each end in one operation. This is particularly true when there are no convenient means of communication between the two ends of a circuit. The method of making this test may be of interest.

Fig. 1 shows a 3-phase circuit in which the left-hand end is assumed to have been connected through a pothead to a disconnected switch. The right-hand end is also to be connected through a pothead to another switch in the same phase relation as the left-hand end. To do this job the conductors must first be identified and correctly arranged for connection to the switch before completing the pothead.

To identify the conductors I connect the ungrounded side of a 110-v lighting circuit to, say, conductor *A* and ground conductor *B* at the switch, as in Fig. 1 and 2. At the other end of the circuit I connect one leg of a 110-v test lamp to ground and, with the other leg, try the conductor ends until the lamp lights, which in this case will be on conductor *A*, Fig. 1.

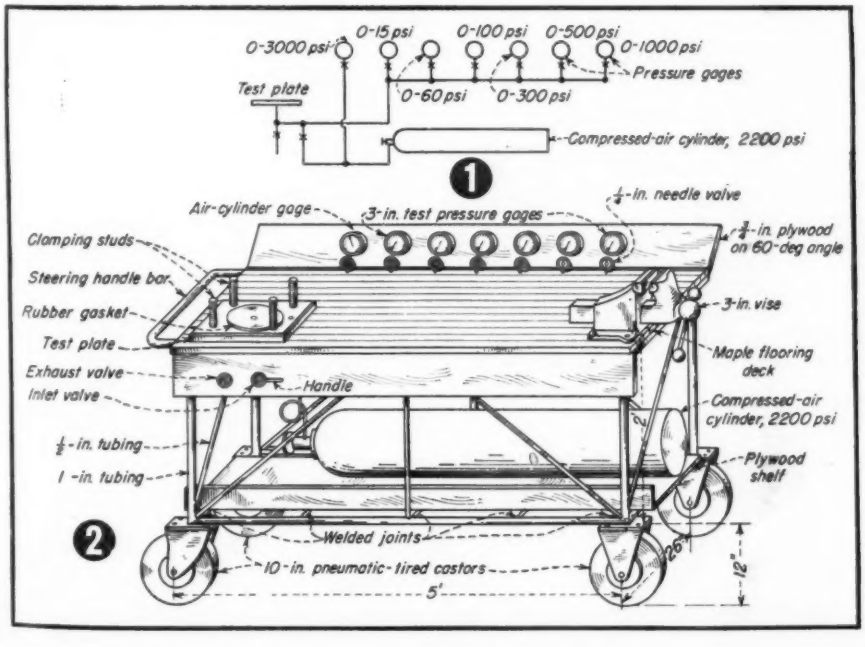
After marking this conductor I put one test-lamp leg on it and with the other leg try the two remaining conductors until I get a light. This indicates conductor *B*, which I mark accordingly. The remaining conductor must be *C*. By this method one man can conveniently make the test on one trip to each end of the conductors.

Hamilton, Ont. J A Coulden

PORTABLE TEST BENCH TO SERVICE SAFETY VALVES

Fig. 2 shows a portable test bench for servicing and calibrating safety valves up to 3-in. size, both screwed and flanged. Chrome-molybdenum airplane tubing is welded into a trussed frame on which is built the bench deck with a shelf below. Make the work deck of ordinary maple flooring on a subdeck of ¾-in. plywood. Attach a steel plate about 13x13x1 in. to one end of the bench, and drill a ⅜-in. hole through its center. Tap both sides of the hole for ¼-in. pipe fittings. Attach a compressed-air supply to the underside and, if desired, screw a fitting into the top side for testing pressure gages. Provide four ⅞-in. studs on a 10-in. diameter circle around the air inlet for clamping down the safety valve.

Mount a 220-cu.-ft. cylinder containing compressed air at about 2200 psi under the bench, and connect it to the under side of the plate and to a header, which serves several accurately calibrated test gages of different pressure ranges. Fig. 1 shows the compressed air and gage connections. Use copper tubing. Pressure of the plant compressed-air system usually is not high enough to test safety valves.



Install needle valves at the cylinder outlet and under each test gage. Equip the valve at the cylinder with a long handle to facilitate accurate control. Suggested ranges of the test gages are: 0 to 15, 0 to 60, 0 to 100, 0 to 300, 0 to 500, and 0 to 1000 psi, depending upon plant needs. If pressures in excess of 1000 psi are required, throttling can be done with the air cylinder's valve and pressure read on the 3000-psi gage. A 3-in. vise is a useful tool to have on the bench, and there is space on the lower deck for a pail of soap suds, wrenches and other tools.

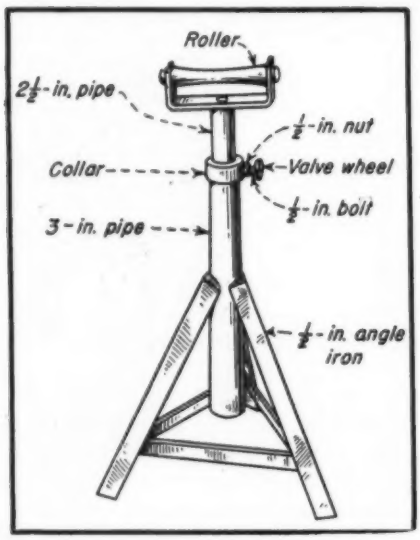
On the test plate, place a piece of live rubber about 9 in. in diameter and 3/16 in. thick having a ½-in. hole in its center to fit over the air inlet. Place the safety valve on the gasket, if it is of the flanged type; otherwise screw it into a flange of the proper size and place the latter on the gasket. By means of two or four finger clamps and the ⅞-in. studs, clamp the valve to the test plate.

The inlet valve is opened, and the

pressure may then be read on the 3000-psi cylinder gage. Depending upon the desired safety-valve setting, the appropriate test gage is placed in service by opening its needle valve.

Using the long-handle needle valve, admit air slowly and watch the pressure gage. Its hand should seldom, if ever, be made to move past the halfway mark on dial before the safety valve opens. Note the pressure. Then close inlet valve and open exhaust valve to bleed off pressure. If a relief valve is being tested, the air will hiss as it leaks past the disk. A pop valve will open almost instantly with a loud pop. If the valve opens at the specified pressure, remove the cap from over the adjusting screw, and mark the position of the latter with a scribe or center punch to facilitate reassembly after overhaul.

W ELWOOD ROSSNAGEL
New York, N. Y.

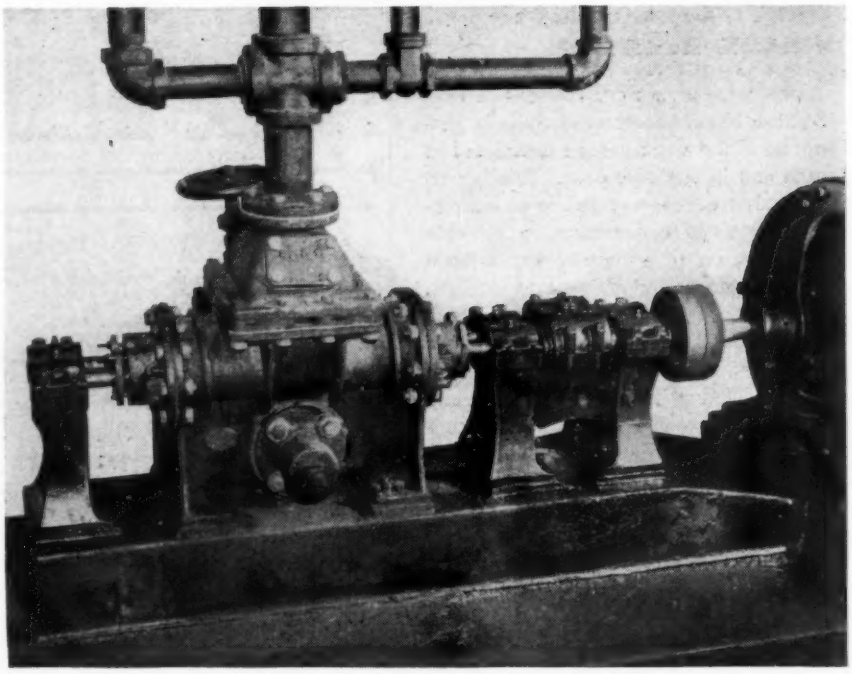


Adjustable Stand Positions Work Correctly

THE ADJUSTABLE STAND in the diagram is a convenient device for supporting one end of long pieces, when a screw machine, pipe threader or cutter is to work on the other end. A tripod, fabricated from three pieces of angle iron, and two pieces of pipe, one telescoped in the other, forms the stand's chief part. The tripod is welded to the larger section of pipe to support the stand vertically.

To adjust the small pipe's position in the large, a loose collar is made from a piece of the large pipe; through it a clearance hole is bored, around which a nut is welded. This collar permits turning the stand's top in any desired position. A roller supported in a bracket on the smaller pipe's top end permits the work to be shifted endwise easily without overturning the stand.

Atlanta, Ga. L L KELLEY
The Linde Air Products Co



WELDING SPEEDS REPAIR OF PUMP

A MOTOR-DRIVEN PUMP in a loft building, stalled on a Friday afternoon. Since there was no standby pump, floors above the fifth were without water because city pressure was not high enough to deliver water to them. This condition made it necessary to repair the pump before Monday morning.

A preliminary investigation indicated that the impellers had jammed in the badly worn pump. It was a screw type about 30 years old, so new parts were not readily available. When the pump was taken to the shop and dismantled we found that the thrust collars had worn the screw shafts to about 70% of their original diameter. One collar, which had broken and gone into the pump, had jammed in the impeller screws.

The pump shafts with their screws were about 3 ft long. To repair the worn areas we filled them by welding, after which the shafts were straightened and rough machined. Metal was then sprayed on the machined surfaces, and the shafts again machined to restore them to their original diameters.

New thrust collars were made and other necessary work done. When the pump was assembled and installed it was apparently as good as new and went into service in plenty of time to meet the Monday morning deadline.

The Maintenance Co M A MYERS
New York, N. Y. Electrical Engineer

Pointers on Operation of Chain Drives

ROLLER CHAINS and their sprockets wear, particularly if the chain is overloaded. When selecting a chain drive, choose one that is oversized for the job because its increased life pays many times for the added cost of the extra capacity.

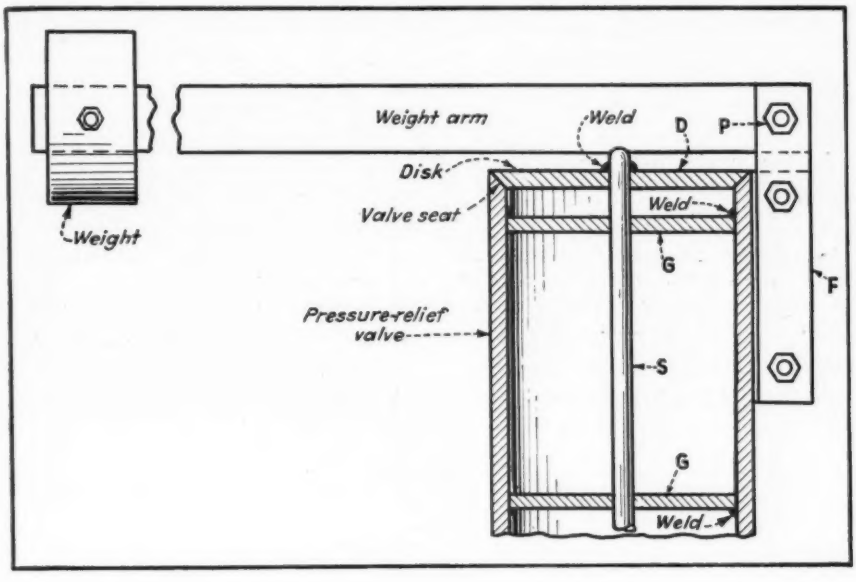
Most serious wear of roller chains occurs on their pins and pinholes where a small amount of wear changes the chain's pitch. Wear on a chain is normally slow, the parts being hardened, but a comparatively small amount of wear causes trouble. For instance, 0.003 in. wear in each joint of a chain running on a 46-tooth sprocket, with 25 links in contact, would cause the last link on the sprocket to be 0.003x25 = 0.075 in. out of pitch.

This causes the chain to ride on the outer edge of the teeth on the slack side, but on the load side it pulls into mesh with a jumpy action and rapid wear on the sprocket results, particularly at heavy loads. Conditions may

get so bad that the chain climbs the sprocket teeth. The chain should be changed before these conditions develop because the sprocket may not need changing.

On our large silent-chain sprocket we machine off the teeth and rim and shrink on a hardened tooth ring, allowing 0.001-in. shrink fit for each inch of sprocket diameter. None of the rings has come loose or worn to where it needed replacing. A shop specializing in gears makes the sprocket rings for us and they cost less than new sprockets.

Sayre, Okla. G M HARDY



MAKES LOW-PRESSURE SAFETY VALVE

AN 8-IN. PIPE, which supplied low-pressure steam to a wood kiln, failed. The line was about 400 ft long, and part of it ran without insulation under floors and in the ground under concrete walks. Condition of this line made repairs almost a hopeless job, so we abandoned it and installed a 3-in. high-pressure one out in the open and reduced steam pressure at the kiln.

When this line was put in service the pressure-reducing valve hunted unless the valve in the control line from the low-pressure side was throttled. This increased the danger of the reducing valve going out of control and filling the low-pressure line with high-pressure steam. Because the low-pressure system was old and in doubtful condition we decided to protect it with a safety valve. Such a valve was not available nor could we get the necessary appropriation to purchase one. So we built a substitute, as in the figure.

For the valve's body we used a one-ft section of extra heavy 6-in. pipe with two ⅜x1-in. guide stripes *G* welded across its center. The pipe was then put in a lathe and a seat turned in one end for the valve disk *D*. At the same time a hole was bored in the center of each guide strip *G* for valve stem *S*. A valve disk was made from a piece of plate steel with valve stem *S* welded in its center. After finishing in a lathe we ground the disk seat to a good fit.

To support the weight arm we welded edgewise to the side of the valve body a piece of ¼x1-in. steel. Two steel strips, *F*, were bolted in place, one on each side of the strip welded to the valve. In the top ends of strips *F* we pivoted the weight arm at *P*. An adjustable weight on the weight arm completed the job. We installed the valve outdoors on an extension of the low-pressure line, and set it to blow at about 10 psi above the pressure required in the kiln. There are several things about this design that are not orthodox, but it did the trick and saved a lot of worry about what would happen if the pressure-reducing valve went out of control.

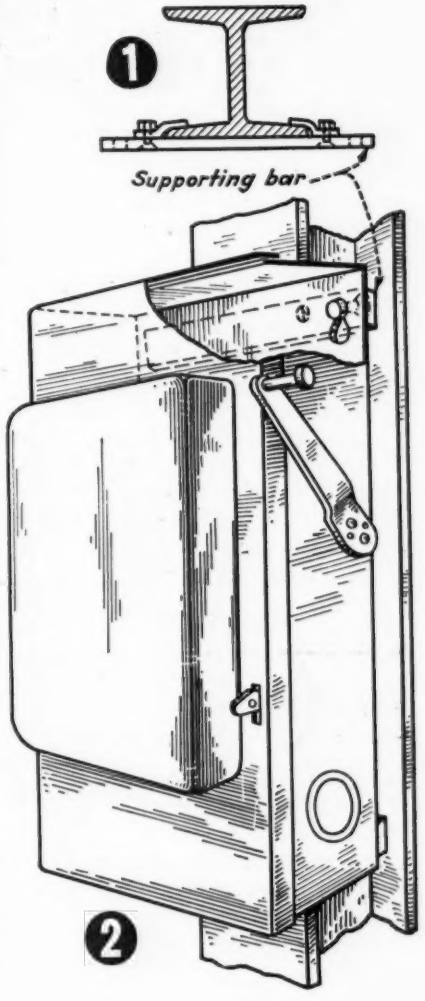
Cincinnati, Ohio H B MCDERMID

Simple Support Makes Starter Installation Easy

WE HAD THE PROBLEM of installing several safety-switch and motor starters on steel columns in our plant. For the installation of the switches and starters we used simple steel bars that could be made up in the machine shop and required no hole boring on the job. Fig. 1 shows how these bars clip to the column with countersunk machine screws.

The bars have a length equal to the width of the switch- or starter-inclosing box to be mounted on them. Holes are bored in the bars' ends to match those in the switch or starter box. Countersunk holes are also bored in the bars for the bolts that bind them to the column, with clips made of the same stock as the bar, which is ¼x1¼ in. cross-section.

When a switch or starter is to be installed, it is sent to the job with the



supporting bars. All the electricians have to do is fasten the bars to the column and mount the equipment on them, Fig. 2. Since the bars are clipped to the columns they can be easily moved up or down to meet any condition by adjusting the height of the unit they support.

Boston, Mass. L W ROGERS

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

1—Are Blowdown Valves in Right Spot?

WE HAVE a blowdown valve-and-pipe arrangement that should be corrected. Before laying out changes in our boiler room, which is over 40 years old, I want to be sure they are justified. The room, which houses two 75-hp hrt boilers, is 16 ft below ground level. It is a hot hole, and cramped for space. The layout for the piping is shown in sketch Q-1.

Some of the men use one sequence, and others use a different one for blowing the boiler. The only idea common to all is to do the job and get out of the hot cramped space behind the boilers as fast as possible. One method is to open the two blowdown valves first, and then open the quick-opening valves one after another. They guess at the amount of blowdown, then kick the quick-opening valves shut and close the blowdown valves.

It seems to me that each boiler should have two valves in the connecting line ahead of the blowdown line. Shouldn't valve *D* on No. 2 boiler be somewhere in the line running from the boiler instead of in the location shown? Assuming the hookup indicated is maintained, what is correct sequence of valve opening, starting with No. 2 boiler? If POWER readers can suggest better arrangements or good ways to handle our present system, we would like to try them.—*WJH*

2—Why Do Brushes Squeal on Starting?

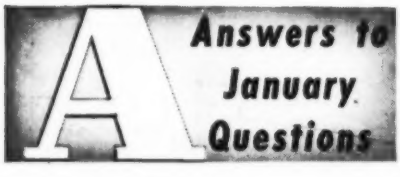
IN OUR POWER SUBSTATION we have a 30-cycle 400-kw rotary converter. The machine has a 625-v dc output. When we bring this unit up to speed the brushes on the sliprings start squealing. They continue to squeal until the machine is synchronized. The converter is started and brought up to speed with a separate 3-phase induction motor mounted on the end of the shaft. There appears to be no vibration or other visible reason for the brushes squealing.

During operation the converter operates quietly except under heavy overload when the brushes start squealing again. The brushes are in good condition and so far have not given any trouble. The rings are copper and brushes a medium-soft carbon.

We would like to stop the squealing as it is annoying and we never know when trouble might start. Can POWER readers suggest a possible remedy for our trouble and give us some idea what is causing the noise during starting and overload?—CLC

Editor's Note: *Every month several good answers cannot be published because they arrive too late to meet the deadline.*

Give your answers a chance; be prompt with your reply. All answers that reach us before the 27th of March will receive consideration for the next issue. Let yours be among them.



How Shall I Handle Hard Water From a Well?

(This is Question 1 from the January issue, with best answers from readers)

We wish to supplement and improve our East African factory water supply by lifting or pumping extremely hard water from a 300-ft well. We plan to treat the water by passing it through a zeolite softener, which we propose to build ourselves.

We considered deepwell pumps for the job, but in view of heavy scaling in the pump and lines, and the water-level variation, which is about 50 ft in a 6-in. casing, we think air lift will be more satisfactory.

*A minimum of 1500 imperial gallons an hour must be raised, and this water treated so it is suitable for diesel cooling and household use. Calcium carbonate causes the principal scale deposit, the water having a total hardness of 944 ppm.**

Can POWER readers tell me whether an air lift is preferable to submerged pumps for this duty, remembering the heavy scaling? If so, what horsepower prime mover is needed to drive the compressor to lift the quantity of water required? What are the principal dimensions for a softener to treat 35,000 gal. in 24 hr?—JEC

*EDITOR'S NOTE: *In problem 1, Reader's Problems, p 114, Jan 1947 POWER a typographical error appeared which considerably changed the hardness of JEC's water drawn from an East African well. The last line of third paragraph should read, "having a total hardness of 944 ppm." This represents fairly hard water whereas 94.4, as printed, is considered only moderately hard as several answers have indicated. If readers want to send in additional information for JEC's benefit in view of this correction we will make every effort to use it.*

Air Lift Is Both Simple and Efficient

ALTHOUGH DEEPWELL PUMPS give satisfactory service on water considerably harder than that found in *JEC's* well, an air lift also provides a good way to pump water.

Since the air lift power plant is located above ground it is in a convenient place for repairs. This might be an important consideration in East Africa.

Also, if more than one well is to be used the one power plant will do all the work. The capacity of the system can be enlarged by adding to the compressor bank.

Since *JEC* indicates a 300-ft well, plus an additional 50-ft variation in water level, the maximum lift should be considered in planning the system. A lift of 300 to 350 ft should have a 50 to 55% submergence. This means that the bottom of the pipe should be approximately 350 ft below surface of water (well, 700 ft deep) as determined by formula for submergence =

$$\frac{700 - 350}{700} \times 100 = 50\%.$$

To avoid restricting water flow the discharge pipe should be checked for correct size. Since the air expands as it passes up the discharge pipe under decreasing head, the air increases in volume from that admitted at the foot of the pipe. To maintain a uniform velocity on deepwells a larger pipe should be used in the upper section of the well.

The air-pipe size depends on volume and pressure of air. Best practice indicates air velocities of 30-40 fps. Since there are no fixed values considerable latitude is allowable.

For best efficiency the compressor should deliver, as closely as possible, the correct amount of air. Too much air results in excessive friction, unnecessarily high pressures, and a waste caused by incomplete expansion in the discharge pipes. If too little air is used it results in too small a quantity of liquid pumped and a varying discharge.

To determine the theoretical amount of air use the equation

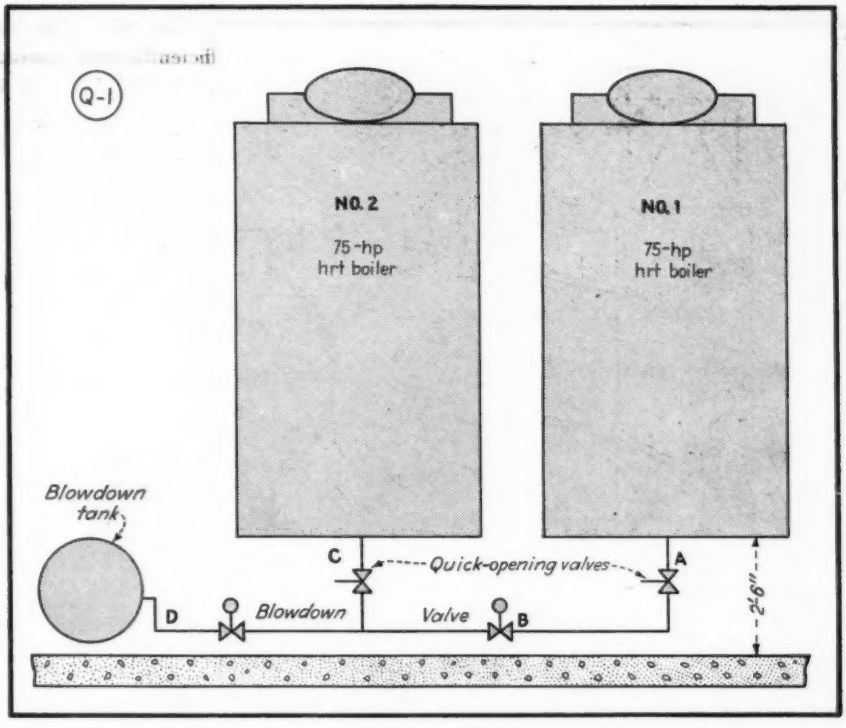
$$v = \frac{\text{lift in feet}}{C \log_{10}\left(\frac{\text{submergence} + 34}{34}\right)}$$

where $C = 296$ for submergence of 50% on an outside air line. This gives

$$v = \frac{350}{296 \log\left(\frac{350 + 34}{34}\right)} =$$

1.12 cu ft air per gal water pumped.

JEC asks about power required to pump water. The compressor minimum working pressure can be determined from $P = 0.434$ x submergence + air friction loss. $P = 0.434 \times 350 + 3 = 123$ psi. Since 1500 imperial gal are required per hour, this amount represents 1830 U. S. gal per hr, or 30.5 gpm. This volume of water would require $1.12 \times 30.5 = 35$ cfm of air at 123 psi. If this air were compressed in a single stage, approximately 10 hp would be required. But remember the value given is theoretical. With 50% efficiency, air requirements double.



A pump as small as that required to pump *JEC's* water at 350 ft probably would be rather difficult to maintain. Therefore, I recommend the air lift since the power required is about the same in each case, and the air lift would represent a simpler installation.

Houston, Tex. R C WILLIAMS

Air Lift Not So Good For System

I SUGGEST that *JEC* use a deepwell pump rather than air lift. Although he states that well water is "extremely hard," and he is therefore concerned with scaling in pump and pipelines, the figure of 94.4 ppm given as the total hardness would indicate that the water is hard, but by no means unusually so. It is approximately the same hardness as Great Lakes water, which is handled satisfactorily by pumps without scaling. Hard water does not ordinarily deposit scale unless its chemical equilibrium is disturbed by heating or by addition of such chemicals as lime or soda ash.

JEC is perfectly correct in planning to zeolite-soften this water for diesel cooling and household use. His water very likely will form scale when the temperature is raised in the diesel cooling jackets and in household heaters.

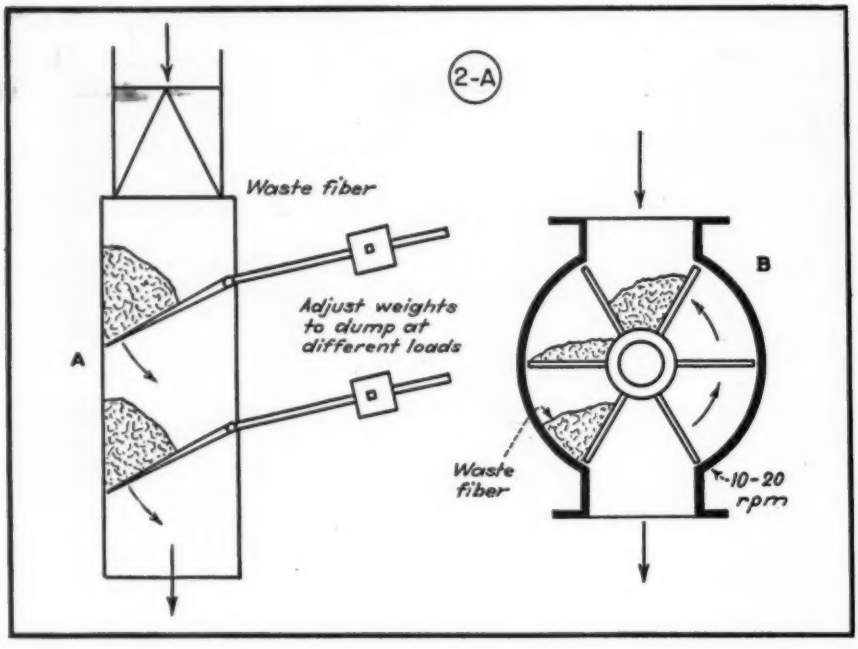
The use of air lift is not recommended for the reason that it will supersaturate the water with air, which has the following effects: (1) Corrosion will be greatly accelerated particularly where the water is warmed. (2) If the well water contains ferrous iron, as is frequently the case, the iron will be oxidized to ferric iron, which is relatively insoluble, and will coat the zeolite in the softener and reduce its capacity. Ferrous iron, if present and not oxidized by air, will be removed by base exchange in the zeolite softener in the same way that hardness is removed. (3) Air may collect in the upper part of the softener tank, which, if not released periodically, may lead to disturbance of the zeolite bed.

I also recommend that *JEC* consult one of the reputable zeolite-softener manufacturers, rather than attempt to design his own softener. The initial cost will be only slightly more, since in any case he will have to purchase the zeolite mineral from a manufacturer, and he will have the assurance that the unit installed will be of proved design and covered by a guarantee.

New York, N. Y. DURANDO MILLER

Reduce Water Hardness With Sulphuric Acid

AIR LIFT CAN BE USED effectively to raise water from a 300-ft well, but it will not avoid the inconvenience of heavy scaling. This is fundamentally caused by the carbonate hardness of the water



which remains the same, no matter what lifting medium is employed.

I suggest *JEC* pretreat his water with acid, in the well bottom. This treatment has been used effectively under similar conditions. Dilute sulpuric acid is used because of its low cost. Equipment consists of a tank above ground, which contains the acid at a convenient concentration, from which it is piped to the well bottom through a proportioning pump. This pump is so rigged that amount of acid fed into well is proportional to amount of water drawn out. Enough acid is mixed with the water to lower pH value of the water so it is maintained at just above the neutral value of 7. In *JEC's* case, 80 to 90 ppm of acid are required. This reacts with the calcium carbonate and produces a much more soluble calcium sulphate and carbon dioxide. This latter must be removed by aeration at the surface.

After aeration, the water may be passed through a sodium-exchange zeolite softener, which will be necessary, especially for that part of the water used for household purposes, as the calcium sulphate causes insoluble curds in the presence of soap.

Such a softener can be built on the spot. The contact tank should contain, in addition to the various layers of sand, a minimum of 40 cu ft of zeolite, assuming that a synthetic sodium zeolite is employed. A tank with a cross-sectional area of about 15 sq ft would do the job nicely, and would allow sufficient contacting time between the water and the zeolite. Daily regeneration with salt solution would be required. These dimensions are based on the assumption that the zeolite capacity is in excess of 6000 grains of hardness per cubic foot (as nearly all synthetic zeolites are).

Finally, under these conditions, the main objection to the use of deep-well pumps is eliminated. It is suggested that these be used as they are much more efficient than the air-lift system, and in addition require much less handling and maintenance. But should *JEC* have other reasons for insisting on an air-lift system, information and specifications on such equipment are easily obtained from standard engineering reference books.

Paterson, N. J. F M GIORDANO

Use 100-Cu-ft Zeolite Softener for Future Load

WATER WITH HARDNESS of 94.4 ppm is considered moderately soft as far as water is concerned. To pump from a varying level *JEC* can make allowance for variation in elevation by extending the suction line of the deepwell pump. Therefore it is practical as well as more economical to use a pump instead of air lift.

To soften 35,000 gal of water, having hardness of 94.4 ppm, in 24 hours will require about 38 cu ft of zeolite. I recommend a 100-cu-ft softener to take care of increased load. This also allows softener to work 48 hours and does not require backwashing as often. Zeolite bed for this service should be from 3 to 4 ft thick.

Quincy, Fla. D J PARMER

What Is Safe Way to Burn Fiber in Hrt Boiler?

(*This is Question 2 from the January issue, with best answers from readers*)

We intend to install a 180-hp hrt. boiler with an underfeed stoker, burning bituminous coal. The boiler will have a setting of about 9 ft. We have a great deal of waste fiber from our plant operation. This fiber, which varies from coarse broom straw to fine hair fiber, will be cut up and blown into a hopper near the roof. From the hopper the fiber will come down a large pipe to a point a short distance above the coal hopper for the stoker. A conveyor, running down the side of the hopper and through the pipe, will keep the fiber from wedging. A slide across the bottom of the hopper will hold back fiber until wanted. Near the bottom of the large pipe will be a smaller pipe with air blowing through it at high velocity. This pipe will carry the fiber into the furnace, and supply necessary combustion air. I do not know what the combustion rate is, but I believe it is quite high.

Will POWER *readers advise what operation is best and safest? If someone has a similar system I would like to see a sketch showing how it works.—HGP*

Blowing Fiber Is A Fire Hazard

THE EQUIPMENT SETUP as described by *HGP* is a fire hazard. If the high-velocity fan stops when the boiler is operating at full load, the fiber in the entire pipe could quite possibly catch fire. Poor draft or accidental closing of dampers could cause the same trouble. This same problem is encountered in power plants utilizing wood waste.

There are several solutions to this hazard. One uses a vertical damper with counter weight to close when the fan stops as shown at *A* in sketch 2-*A*. Another uses a rotary valve, as at *B*

in the sketch. This valve is placed before the fan and delivers fiber to pipe, and then it is blown into the furnace. The motor operating this valve can be innerconnected to the fan motor, so it operates at same time.

A short section of screw conveyor with one flight removed will also provide an effective fire stop. It should be installed before the fan, the same as a rotary valve. Some of the above items are available from manufacturers who design and install their particular type of equipment. Steam jets to extinguish fires in pipes will be a wise investment.

Boyertown, Pa. E S EISENHARD

Blow Waste Fiber Over Fire At Angle

HGP MAY SAFELY USE FIBER in firing his boiler by employing a method similar to that shown in sketch 2-*C*. He should construct lead pipe from fiber hopper to carry about one half of maximum fiber output. Blower pipe enters furnace wall at an angle, as shown with flare at termination. It has an opening that is large enough not to reduce blower capacity.

To insure against flashback caused by blower failure, install a valve between blower and furnace. This valve has a counterweight, set so it opens when blower is at full speed, and closes at reduced speed.

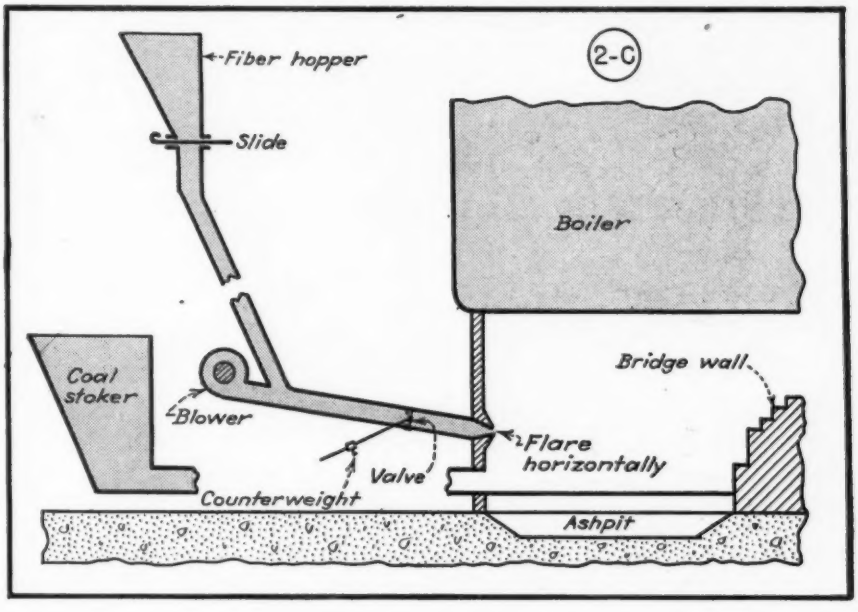
Quincy, Fla. D J PARMER

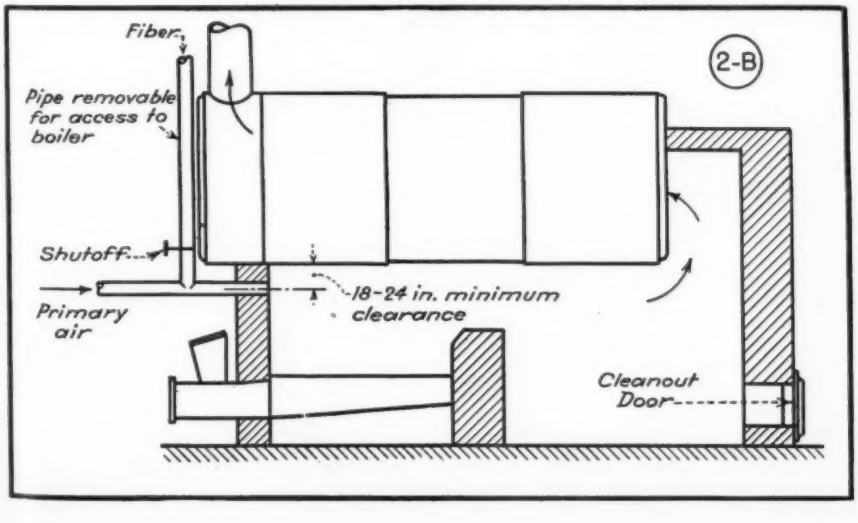
Avoid Deposits of Fiber In Flue-Gas Passages

FOR BEST RESULTS HGP should drop fiber down pipe as vertically as possible into an air jet blowing through a short horizontal pipe into the furnace as shown in sketch 2-*B*. The air-fiber mixture should enter the furnace at a velocity of about 3000 ft per min. At a lower velocity there is danger of flashback into the storage hopper. If a large amount is burned then secondary air should be introduced at a lower air pressure by a windbox around the burner, similar to a pulverized-coal burner. If this is not provided, the air to the stoker will have to be increased to supply enough combustion air.

With best combustion, there will be an appreciable carryover to the rear of the bridgewall. This carryover will increase deposits in the gas passages. Attention to the details of the burner to obtain good mixing of the air and fiber, and turbulence of the mixture, will minimize this trouble.

Staten Island, N. Y. R ATLAS





Dutch Oven Burns Waste on Hrt's

SPECIAL FURNACES are employed for burning fiber waste and shavings. A dutch oven is used for this purpose in connection with hrt boilers. The material should not be blown directly into the furnace, but can be discharged by the blower into a cyclone. Here the surplus air escapes at the top and waste works to bottom, where it slides by gravity through pipes to the furnace. Waste can also be sent to a storage bin when not required for immediate use. Piling up of waste on grates interferes with the admission of air and combustion of coal. For proper waste combustion, provision must be made for admission of air above grates. High air and gas velocities should be avoided, as they carry waste and ashes into boiler tubes.

Oaklyn, N. J. C A WILKES

Waste Fiber Can Be Burned Easily

WE HAVE A SYSTEM for burning waste fiber in our power plant similar to that described by *HGP* except that we burn it in connection with an oil-fired water-tube boiler. The fiber is blown in from the factory to a small hopper just back of the plant. We take it from this receptacle and feed it to a blower through a screw conveyor. The blower sends the fiber in over the top of the fire. The blower feeds an excess of air to the furnace; therefore we shut off some air to the burners and let the

(*Continued on page* 168)

RECIPROCATING-PUMP Q&A FOR POWER ENGINEERS

By E F WRIGHT

7—Cushion Chambers: Size and Operation

In the seventh of a series, E F Wright, chief engineer, reciprocating pump division, Worthington, selects questions and answers that give practical understanding of construction, operation, characteristics, troubles and remedies.

Q 1—What is an air chamber?

A—Fig. 1 shows a common form of air chamber used on the discharge of a double-acting duplex pipeline pump. Such a chamber is partly filled with air or gas, which contracts and expands to absorb most of the pressure changes caused by variation in flow from a reciprocating pump.

Q 2—What is a vacuum chamber?

A—It has long been customary to speak of a cushion chamber on the discharge side of a pump as an "air chamber" and a similar chamber on the suction side as a "vacuum chamber." In the writer's opinion it would be far less confusing and more specific to use the terms "discharge cushion chamber" and "suction cushion chamber."

Q 3—How should cushion chambers be connected to a pump?

A—A cushion chamber is far more effective if connected so that flow is directly into the chamber. Fig. 2 to 4 show three methods of connecting a suction cushion chamber. Where the pump suction chest has two opposite connections, best results are obtained with the cushion chamber opposite the suction pipe, Fig. 2. For pumps with a single suction opening, Fig. 3 is almost as effective. Fig. 4 shows the wrong way to connect a suction cushion chamber. The same rules apply when connecting a discharge cushion chamber although the difference in results is not so great as for a suction chamber.

Q 4—Why are cushion chambers desirable in connection with reciprocating pumps?

A—As brought out in previous articles flow rate of every reciprocating pump, either direct-acting steam or power, goes through a periodic variation. Unless it is practical to use cushion chambers the entire fluid column, both suction and discharge, must follow this flow pattern. With cushion chambers, flow in the piping is more or less constant since variation at the pump is absorbed by flow in and out of the chambers.

Q 5—When should cushion chambers be used?

A—Use them when the care required to keep them charged brings a worthwhile return in smoother pump operation and pipe flow. An exception is where the cushioning medium will contaminate the fluid pumped as would occur with an air-charged chamber on a pump handling deaerated boiler feedwater. On reciprocating pipeline and oil-well drilling pumps relatively elaborate apparatus is justified to charge and retain the charge in discharge cushion chambers.

Q 6—Why do cushion chambers require charging?

A—The reason is that air or gas dissolves into fluids commonly pumped at

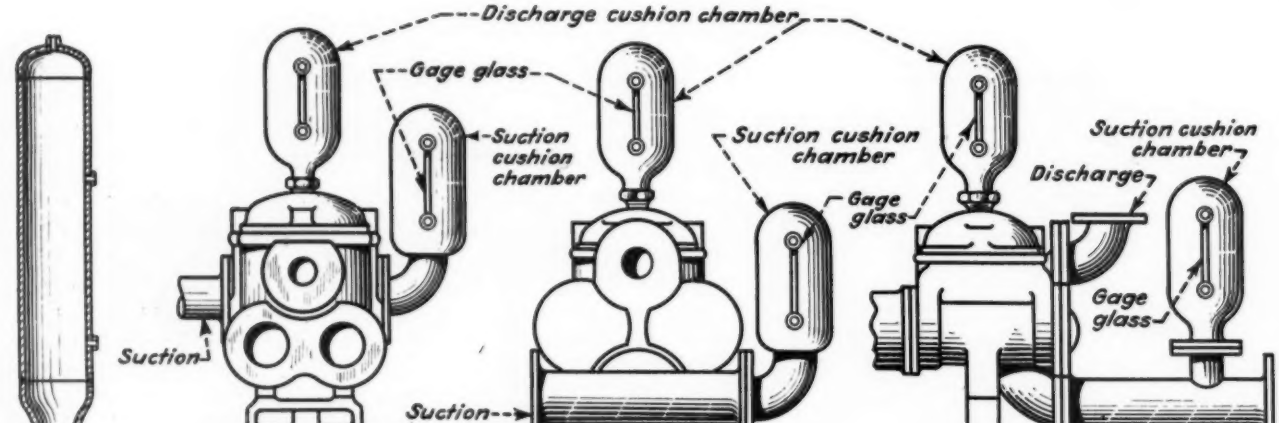


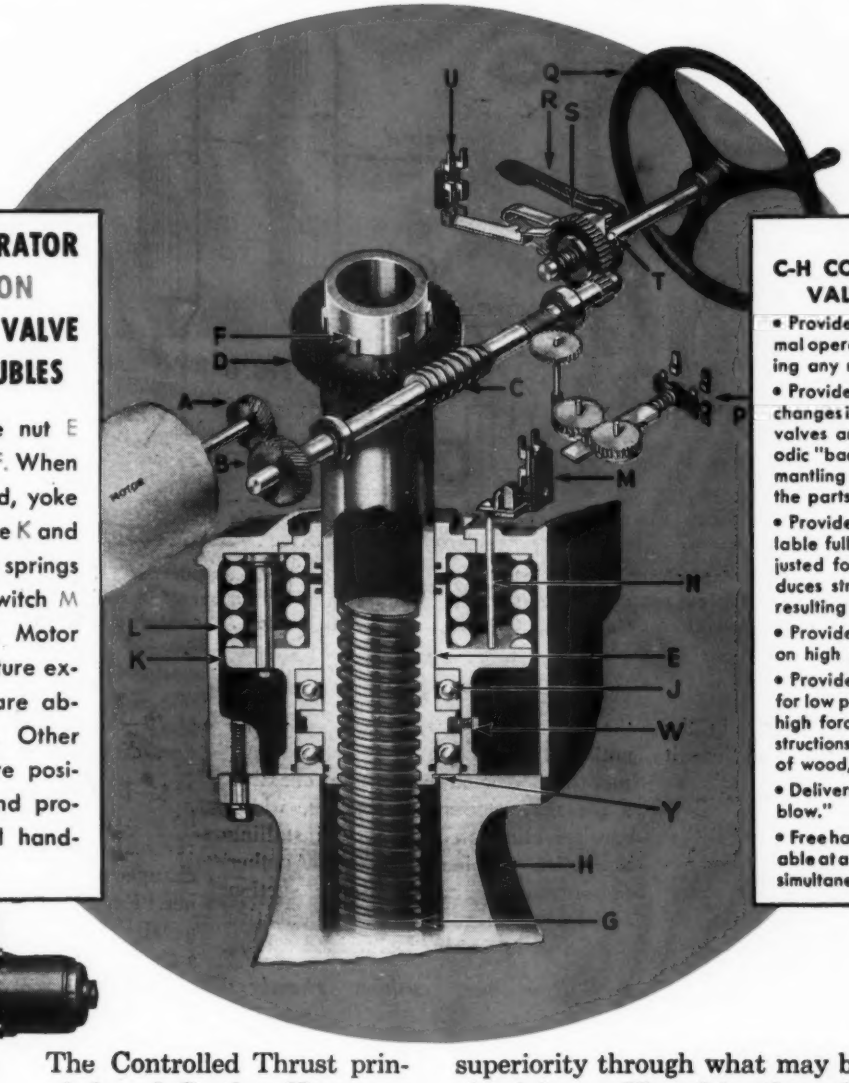
FIG. 1 FIG. 2 FIG. 3 FIG. 4

Fig. 1—Common form of cushion chamber as used on discharge of double-acting duplex pipeline pumps. Fig. 2 to 4—Three methods of connecting the cushion chamber to suction of double-acting duplex reciprocating pumps

BETTER SEATING ARRANGEMENTS

FOR ALL VALVES

OR... HOW TO GET TIGHT SEATING WITHOUT JAMMING



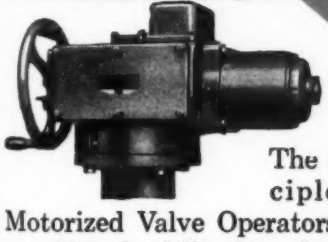
THE VALVE OPERATOR CONSTRUCTION THAT PREVENTS VALVE JAMMING TROUBLES

Motor drives yoke nut E thru A, B, C, D and F. When valve disc is seated, yoke nut rises, lifting plate K and rod N, compressing springs L and operating switch M which stops motor. Motor drift, and temperature expansion of stem, are absorbed in springs. Other elements shown are position limit switch and provision for optional hand-wheel operation.

Features of

C-H CONTROLLED THRUST VALVE OPERATORS

- Provides tight closure under normal operating conditions, eliminating any need for "final" seating.
- Provides for large temperature changes in high temperature steam valves and gas valves. No periodic "back off" necessary. No dismantling of valve to "unfreeze" the parts.
- Provides for accurately controllable full power drive, easily adjusted for service conditions. Reduces strain and wear and tear resulting from other systems.
- Provides high speed operation on high pressure valves as well.
- Provides ADEQUATE Protection for low pressure valves... against high forces, against artificial obstructions such as gravel, a piece of wood, etc., in the valve.
- Delivers an unseating "hammer blow."
- Free hand-wheel operation available at any time. Protected against simultaneous electrical operation.



The Controlled Thrust principle of Cutler-Hammer Motorized Valve Operators for all kinds of valves provides the following advantages:

It *always* assures a tightly seated valve regardless of the frictional condition of the valve stem or the driving mechanism.

It *definitely* prevents damage to a valve from the expansion and contraction of valve parts under extremes of temperature.

It *unfailingly* provides correct seating no matter how swiftly the valve is closed.

On water lines, it prevents damage in case foreign matter such as gravel lodges in the valve.

Cutler-Hammer *Controlled Thrust* Valve Operators gain their superiority through what may be called a transferable fulcrum. They drive through a yoke nut fulcrum established by heavy steel springs whose compression is equal to the desired tight seating pressure. When the valve is accurately seated, the *seat* becomes the fulcrum, the yoke nut retracts, opening the motor circuit, and motor drift is absorbed by the springs. Moreover, the same accurate seating is maintained as valve parts expand and contract.

Now is the time to investigate this proven superior motorized valve operator for your plant. Available as standard equipment on all leading makes of valves.... CUTLER-HAMMER, Inc., 1209 St. Paul Ave., Milwaukee 1, Wis.

CUTLER-HAMMER
VALVE CONTROL
C-H

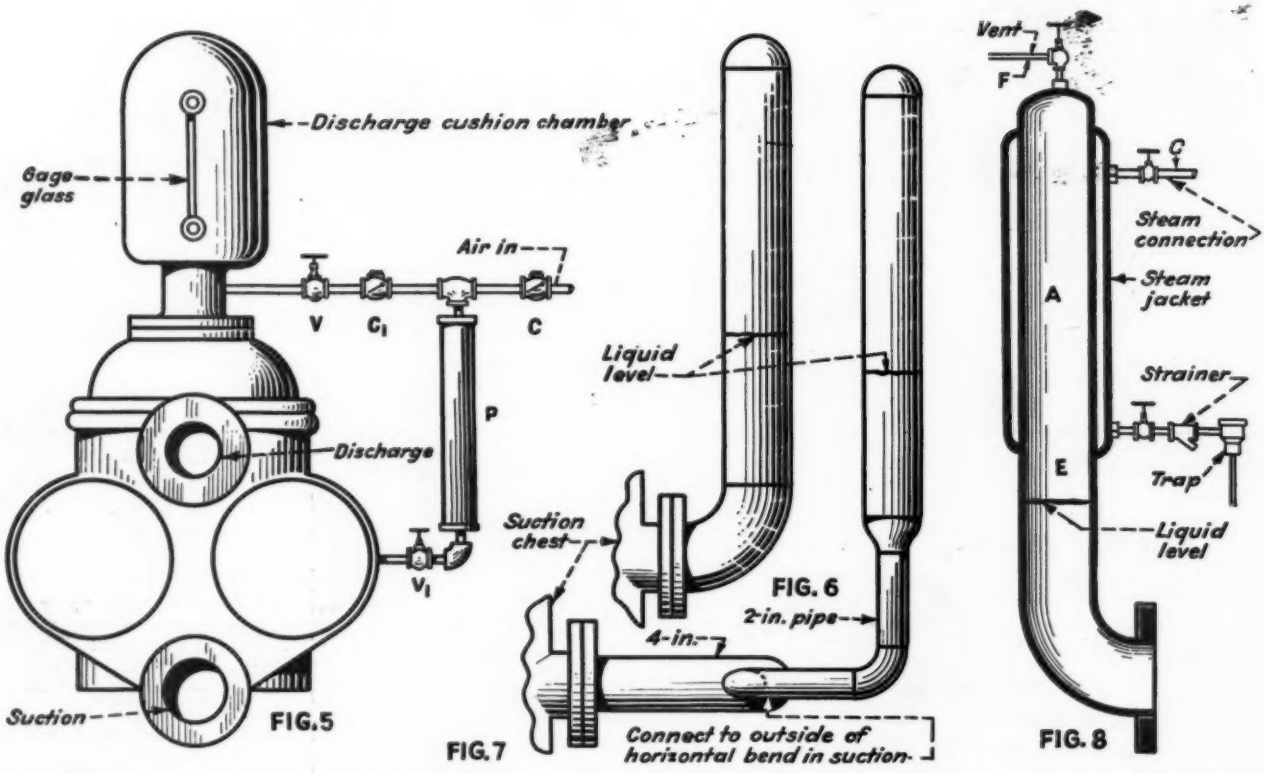


Fig. 5—Snifter-valve arrangement charges air into discharge cushion chamber on duplex reciprocating pumps. Fig. 6 and 7—Setups of cushion chambers on suction of triplex boiler-feed pumps. Fig. 8—Steam-jacketed suction cushion chambers for reciprocating boiler-feed pumps. Cushion space A contains steam at suction pressure

a rate proportional to pressure in the chamber. Under extreme conditions it may be necessary to charge a discharge cushion chamber every hour. Conversely, under a high suction lift it may be necessary to remove accumulated air from a suction cushion chamber to maintain good volumetric efficiency.

Q 7—Should cushion chambers have a gage glass to show liquid level?

A—Yes, install one where there is any question of the amount of air or gas in the chamber. A water-logged cushion chamber is worse than none at all because it gives the false impression of helping the installation. A gage glass shows both amount of cushion and effectiveness of the chamber-charging device.

Q 8—Which should be used oftener, a suction or discharge cushion chamber?

A—Generally a suction cushion chamber is more important than a discharge cushion chamber. On the suction side of a pump a relatively small pressure fluctuation may momentarily reduce pressure to the point where the fluid vaporizes. Severe pounding results when this vapor condenses under increased pressure. A similar or considerably greater pressure fluctuation on the pump's discharge side may have no noticeable effect. On direct-acting steam pumps a discharge cushion chamber alone may cause disturbances, which can be eliminated only by installing a suction cushion chamber. Another factor strongly in favor of a suction cushion chamber is that its effective operation is easily maintained.

Q 9—How are cushion chambers charged?

A—A suction cushion chamber on a pump operating with a suction lift frequently accumulates air released from the water because of reduced pressure. This condition provides a self-regulating cushion. Where the amount of air released is excessive it may be necessary to use a vacuum pump or an ejector to remove air from the chamber. Where pressure in a discharge or suction chamber is greater than atmospheric, best means of charging is with compressed air or gas. Where air is not available at a suitable pressure, snifter valves, or a charging device, Fig. 5, may be used. Air enters cylinder *P* through check valve *C* during the suction stroke. Then the discharge stroke forces this air into the cushion chamber through check valve C_1. Valves *V* and V_1 are used to regulate amount of air handled by each pump stroke.

Q 10—How large a cushion chamber does direct-acting steam pump need?

A—Best size for any installation can be determined only by trial, because at reversal a steam pump's action is changed somewhat by a cushion chamber. Experience shows that results are usually good on a simplex pump with a chamber volume six to eight times the displacement of a single stroke. A duplex pump's cushion-chamber volume is usually three to four times the single-stroke displacement. Sometimes a larger or smaller chamber may be necessary for either a simplex or a duplex steam pump.

Q 11—What size cushion chamber does double-acting duplex power pump need?

A—This pump goes through a complete cycle once each revolution, and the total flow to and from a cushion chamber is about 3.5% of the volume delivered during a complete revolution. If air volume in the chamber is 30 to 40 times the amount absorbed, or 1 to 1.5 times displacement of one pump revolution, pressure fluctuation should not exceed 3 to 5% of the average pressure. A larger air volume provides a proportionate reduction in pressure fluctuation.

(*Continued on page* 160)

Double Check

ON BOILER WATER LEVELS

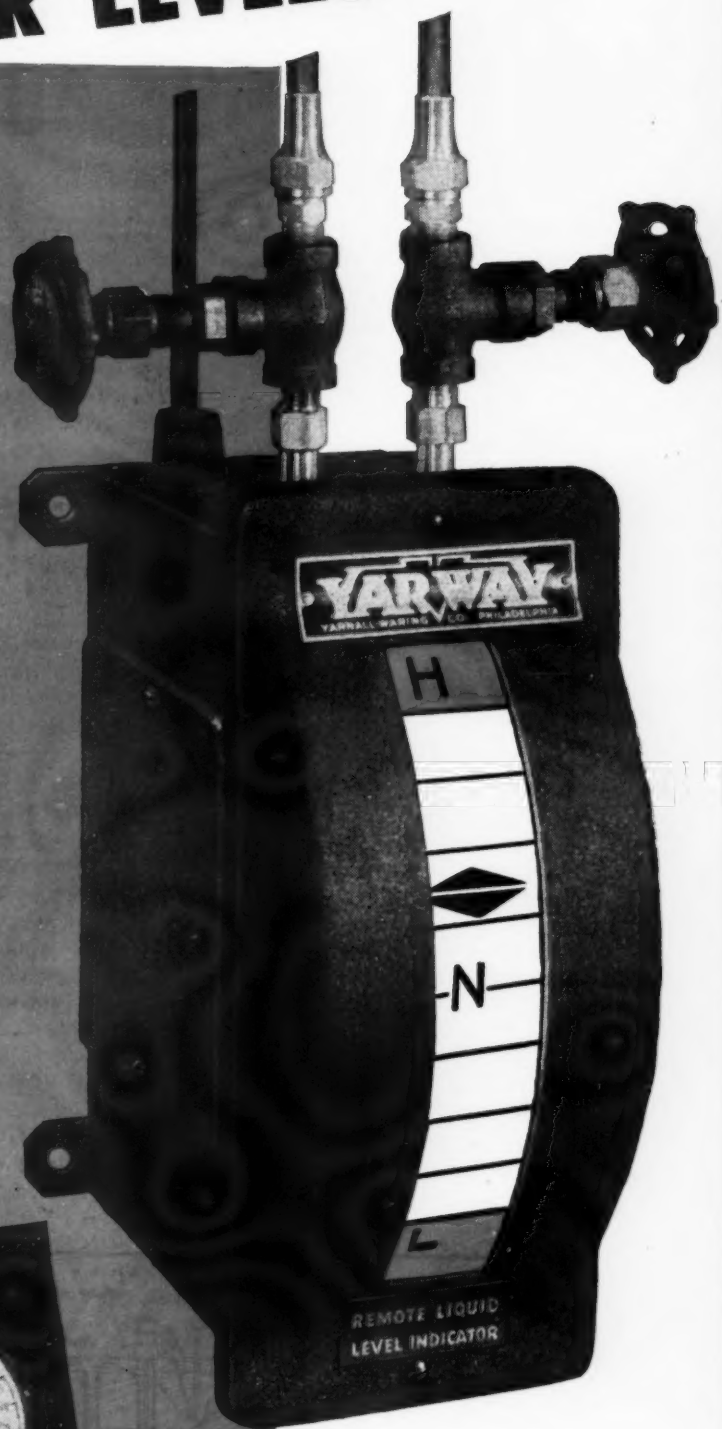
Here's an instrument that brings boiler water level indication right down to eye level, on the instrument panel or other convenient location—a perfect *check* on hard-to-see overhead gages.

Yarway's Remote Liquid Level Indicator is always accurate because it is operated by the boiler water itself—by the pressure differential between a constant head of water and the varying head in the boiler drum. Action is instant, constant, frictionless. *There are no stuffing boxes.* Indicating mechanism is never under pressure. Mechanism is perfectly balanced on jewelled bearings outside of the pressure chamber.

From coast to coast, the Yarway Indicator is meeting with enthusiastic approval. One prominent user said, "If I couldn't get another one like it, I wouldn't sell the one I have for many times its cost!"

More than 2500 have already been bought for indicating boiler water level, feed heater water level, and superheater pressure differential. For complete description of operating details, write for Bulletin WG-1821.

YARNALL-WARING COMPANY
100 Mermaid Avenue Philadelphia 18, Pa.



Typical instrument panel mounting of Yarway Indicator in rubber manufacturing plant.

One of two Yarway Indicators mounted on end of instrument panel in boiler room of Western utility.

YARWAY REMOTE LIQUID LEVEL INDICATOR

WATER-TREATMENT QUESTION BOX

ACTION OF SILICA IN BOILER WATER

By K M Herstein and John S G Shotwell

▶ THIS TENTH QUESTION in a series on water conditioning discusses silica and its effects in boiler water.

Goodwater Laboratory
Drum City, U. S. A.
Dear Chemist:

What is the importance of silica in boiler feedwater? A few years ago little attention was paid to it, but now it is one of the first things mentioned by feedwater-treatment salesmen.

Yours truly,
Walter Tender

Dear Walter:

Silica is present in most natural waters, either as finely divided silt or as dissolved silicates (like water glass). It can also be introduced into water by sand filters, concrete tanks or pipes, and even by siliceous softeners. Unless special precautions are taken silica finds its way into the boiler circulation where it is a great trouble maker.

In the days of relatively simple low-pressure boilers, silica was considered a harmless nuisance. Chemists felt that most of it was present as extremely finely divided inert silt that settled out as a harmless sludge. Even after discovery that some silica was present in the soluble form chemists thought it would break down under heat to form a precipitate of harmless grains. Such forms as water glass or sodium silicate were actually added to prevent corrosion and sold for water softening. They may have helped reduce corrosion but they did not reduce scale.

The advent of large-capacity high-pressure boilers revealed the fact that silica, carried over with the steam, formed hard deposits in superheaters, turbine blades and process equipment. These facts started an intensive study into the chemistry of silica, which showed that it was an extremely active scale former, combining with other salts in the water to lay down a hard, dense scale. Further, it increases the tendency toward caustic embrittlement, a form of metal failure.

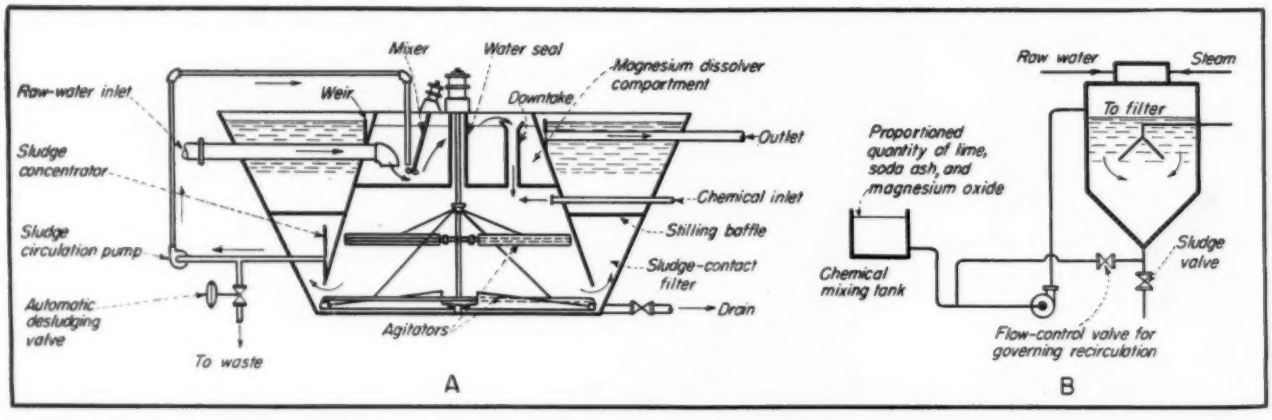
Silica can be reduced in boiler water by the adsorbing action of ferric hydroxide or magnesia. For waters that require coagulation and do not contain large amounts of silica, the use of ferric sulphate as a coagulant effectively reduces silica. Ferric hydroxide works best at pH 9.0 to 9.5, but is not suitable for hot-process work.

Two methods using magnesia differ in that one is carried out at boiling temperature and the other at normal temperature. Latter method depends on filtering through a sludge blanket while recirculating a portion of the sludge.

In a 2-step demineralizing process, sodium fluoride added to the entering water is converted to hydrofluoric acid by the hydrogen zeolite. The hydrofluoric acid reacts with silica to form fluosilicic acid which is removed later in the process. Some question has been raised regarding difficulties that may be encountered in boiler operation by the small amount of fluoride (0.5 to 1.0 ppm) present in the process effluent. Present studies will find the answer.

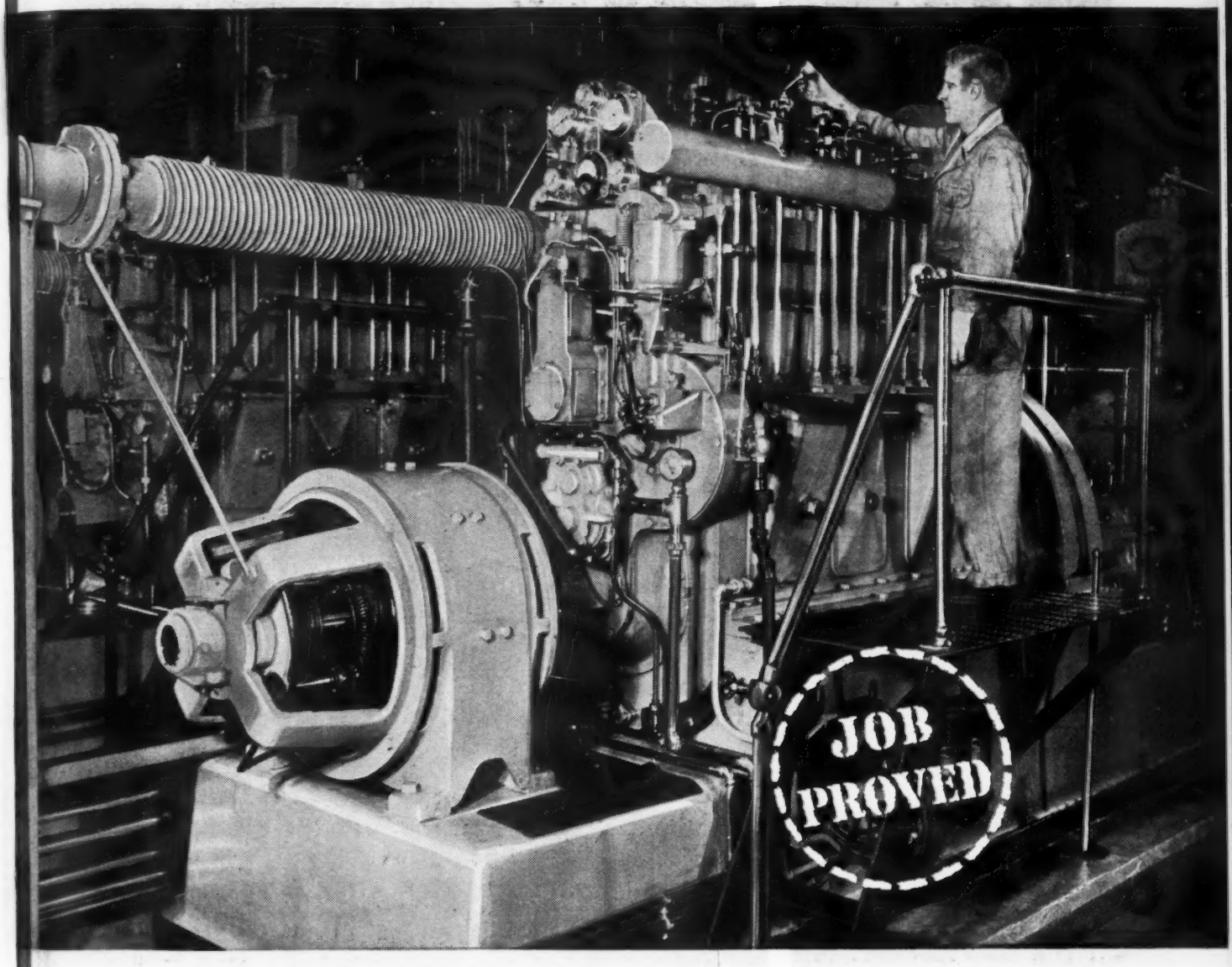
Treatment costs of fluosilicate anion-exchange process are high when compared to older methods, but it produces virtually silica-free water. High cost comes from (1) using expensive sodium fluoride salt at the rate of about 4 ppm for each ppm of silica contained in the water (2) extra acid and alkali required to remove, by demineralizing, sodium fluoride added for treatment. A recent development uses a highly basic caustic-regenerated anion-exchange resin to absorb the silica.

Yours truly,
Chemist
Goodwater Laboratory



A: Precipitator designed specially to reduce silica in raw water. Upward water flow passes through a blanket formed by magnesia sludge that adsorbs silica. B: Hot process reduces silica by recirculated magnesia sludge

Two Years Without Repairs, Replacement or Overhaul



SUN DIESEL LUBRICANT . . .

Keeps Two Diesels in Perfect Condition and Puts an End to Frequent Overhauls

A municipal plant which uses two 125-horsepower Diesels for pumping was confronted with a serious lubrication problem. Oil was forming sludge with the result that frequent shutdowns and overhauls were necessary.

A Sun Engineer was called in and after careful analysis recommended a Sun "Job Proved" oil specially refined to stand up under the particular operating conditions.

With Sun oil in the crankcases, the engines were kept in regular service for more than two years. Sludge disappeared. Oil consumption dropped. Mechanical repairs, replacements and overhauls were reduced to practically nothing. There was no excess carbon formation.

The ability to solve problems like this is typical of "Job Proved" products and of Sun Engineers. Wherever you have a tough problem involving petroleum products, whether in Diesel engines, turbines, gas or gasoline equipment, call your nearest Sun office or write Department P-3.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

SUN

SUNOCO

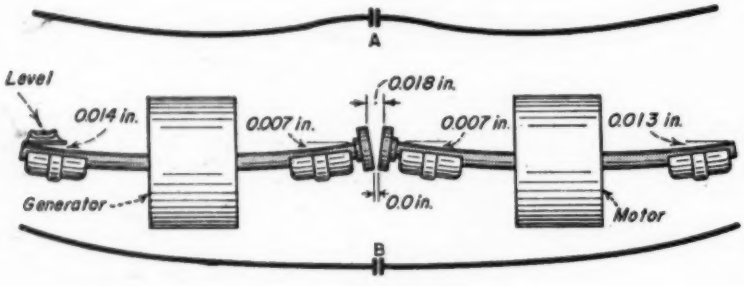
INDUSTRIAL PRODUCTS

HOW TO ALIGN ROTATING MACHINE SHAFTS

▶ WHEN TWO MACHINES are direct connected, the two shafts must line up true if shaft whip and hot bearings are to be eliminated. Rough alignment can be made at room temperature, but a final check should be made at machine operating temperature.

Most convenient point to measure alignment is between the coupling halves. Treat flexible couplings the same as solid ones, keeping out-of-parallel of coupling faces less than 0.002 in. for each foot of face diameter. Be careful in opening the coupling of a 3-bearing machine, block up unsupported half of shaft, insert several bolts of smaller diameter, and adjust them to prevent the coupling falling apart before removing the remaining permanent bolts. Then adjust the temporary bolts so that coupling faces can be separated slightly, but not enough to disengage the male and female joint.

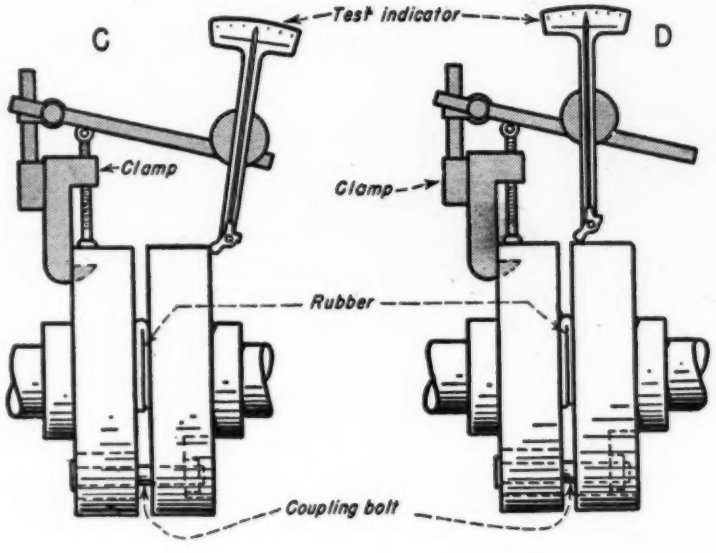
First procedure is to check the end play in both shafts, and set the machines so that coupled shaft still has end play in both directions. Then roughly align the two shafts, vertically by laying a straight edge across the coupling in line with the shaft, and horizontally by measuring coupling face clearance at 90-deg points with a feeler gage. Different types of couplings require different indicator setups, but the methods that are described below tell how to make the final precision check that assures accurate alignment.

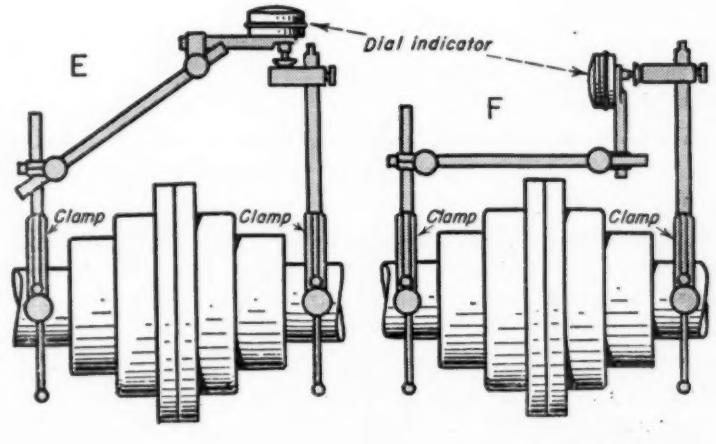


1 Shafts that carry heavy rotors generally sag between bearings, as illustrated by exaggerated view, above. Bolting the coupling together under these conditions forms another bend as at A. General practice is to lower the two inboard bearings, raise outboard ones, or make equal and opposite compensation on each to produce uniform bend throughout at B.

2 Prepare the coupling by jamming the two halves apart with a piece of rubber, insert a loose-fitting bolt and mount the test indicator as in C. This setting shows vertical and horizontal axial alignment when both of the shafts are rotated together during one turn. Read at every 90-deg point. Setting at D checks radial alignment when shafts are rotated and readings taken at 90-deg points of the circle.

3 When a machine has flexible couplings or a dial indicator is used, make suitable brackets that clamp directly to the shafts. Arrangement in E measures radial alignment, and that in F alignment in the axial direction when shaft is turned as a unit and readings taken at 90-deg points. Coupling halves must turn freely without binding. For accuracy keep them separated maximum amount.





AN EDWARD CONTRIBUTION TO BETTER VALVE PERFORMANCE—EVALIZING

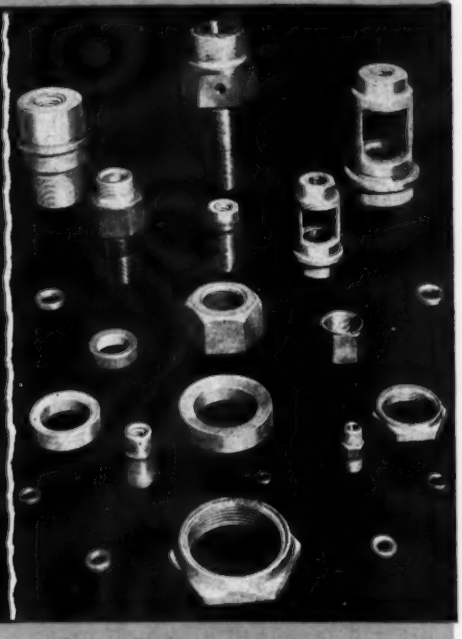
how EVALIZING CHANGED AN ANCIENT FEUD INTO A BEAUTIFUL FRIENDSHIP

STEEL RUBBING AGAINST STEEL, such as a valve stem rotating in a valve bonnet, has often resulted in trouble—galling, freezing abrasion or wear that reduced valve life and increased maintenance.

And then Edward developed *EValizing* to the immediate and lasting benefit of Edward valve users.

An easy hand test shows how silken-smooth and frictionless is this contact of bonnet and stem with the bonnet threads EValized.

In high temperature tests duplicating actual operation, valve stems have been rotated through EValized bonnets 5000% more than regular bonnets.



Edward EValizes many valve parts—bonnets, junk rings, packing nuts, bearing plates, and nuts for large valve body-bonnet bolting.

EValizing is an exclusive process for coating steel parts with abrasion resistant bearing material.

EValizing reduces friction between moving steel parts by approximately 50 per cent—it practically eliminates galling and freezing where parts must slide or turn freely in contact with other steel parts.

EValizing, developed for gall resisting qualities, also fights corrosion.

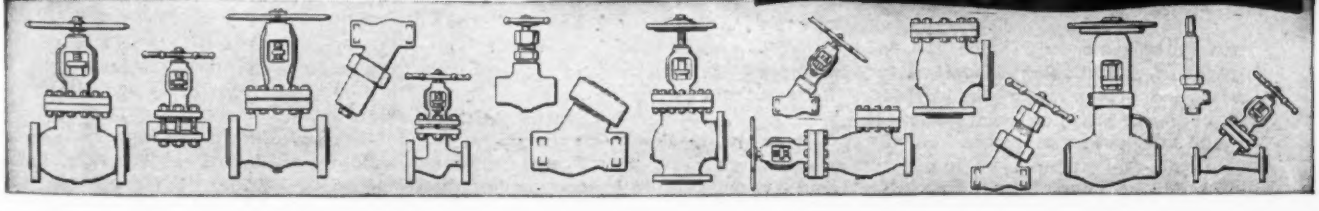
EValizing is another Edward contribution to better valve performance.

ROCKWELL

Edward Valves, Inc.

Subsidiary of Rockwell Manufacturing Company

EAST CHICAGO, INDIANA



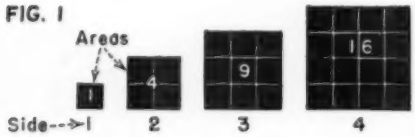
MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

22—Useful Facts From Geometry: 2

If a plane figure is enlarged without change of shape (as by photography, photostating or pantograph) the area increases in proportion to the square of any selected dimension. Try this for squares of 1, 2, 3 and 4 sides. Areas are 1, 4, 9 and 16, as in Fig. 1.

FIG. 1

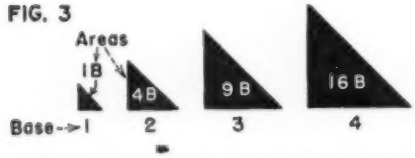


For a circle, the area is always less than the square of the diameter. Yet the area is still proportional to the square of the diameter. The 4-in. circle has exactly 16 times the area of the 1-in., and the 3-in. circle exactly 9 times, Fig. 2.

FIG. 2

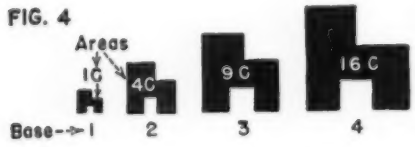
Areas of triangles pictured below in Fig. 3 (each half a square) are actually ½, 2, 4½ and 8, but still in the proportion 1, 4, 9, 16, as before.

FIG. 3



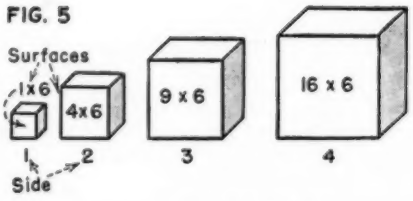
We begin to see that this relationship holds for any shape; for example, that shown below, in Fig. 4.

FIG. 4



Now this same rule holds for the surfaces of solid bodies as well as for the shapes drawn on a flat surface. This is most obvious for a cube. It has six sides, each a square. So the surface of any cube is 6 times the square of one edge, Fig. 5.

FIG. 5



A sphere or ball evidently has somewhat less surface than a cube whose edge equals the sphere's diameter; yet the same proportion holds. Surface of a 4-in. ball is exactly 16 times that of a 1-in. ball, Fig. 6.

FIG. 6

Now let's work a few problems illustrating effect of dimension changes on surface. First: What is effect on quantity of blueprint paper required if drawing scale is reduced from ½ in. per ft to ⅜ in. New dimension is ¾ of the first, so new area is ¾x¾ = 9/16, or 56%; saving is 44%.

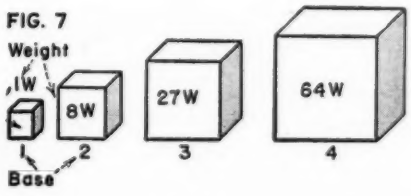
Another problem: A shape cut from plywood weighs 12 lb. What would it weigh if a certain dimension were increased from 32 in. to 48 in. with no change in shape? Note that 48 ÷ 32 = 1.5. Then 1.5x1.5 = 2.25, and 2.25x12 = 27-lb weight.

How much lumber (area) and outside paint can be saved by cutting a building plan 12% in all dimensions? The final dimension is 88% of original; so the final surface is 0.88x0.88 = 0.7744, or 77.4%. Saving is 22.6%.

Problem: A certain part is a brass hex rod, ¾ in. across flats. How much is brass cost increased if rod is thickened to ⅞ in. across flats? Ratio of dimensions is 7/8 ÷ 6/8 = 7/6. Then 7/6x7/6 = 49/36 = 1.36, and cost increases 36%, assuming a fixed cost per lb for the hex rod.

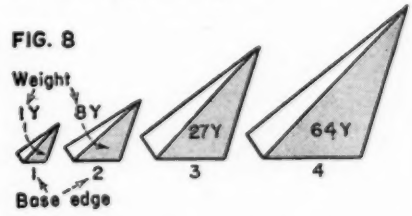
If any solid shape is enlarged without changing the proportions, volume and weight go up in proportion to cube of any dimension. This holds for actual cubes. Volumes are 1, 8, 27 and 64 for edges of 1, 2, 3 and 4. Weights must be proportional to volumes. Fig. 7.

FIG. 7



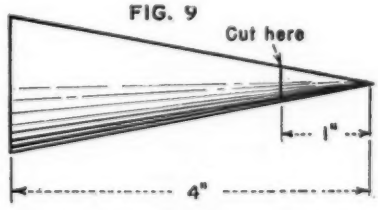
It is equally true for spheres or any other shapes, as the irregular pyramids shown below in Fig. 8.

FIG. 8



Problem: How much will weight of a steel cone be reduced by cutting off the point to a depth equal to ¼ length of cone? Both cutoff and original cones have same shape. Since little cone has ¼ the length, its relative weight will be ¼x¼x¼ = 1/64 = 0.0156. So weight loss is 1.56%, Fig. 9.

FIG. 9



Problem: Conical coal pile is to be built up from fixed central spout until pile base is a circle with 80-ft dia. To find how much coal will be stored here, engineer makes model pile of the same coal with 10-ft dia. cone, by spilling it from a single spout and letting it find its own angle of repose (same as large pile). If coal in sample pile weighs 4560 lb, what is tonnage of big pile?

Ratio of dimensions is 8, so ratio of weights is 8x8x8 = 512. Pile holds 4560x512 ÷ 2000 = 1167 tons.

Home of Girard Trust Carries on Fine Tradition

GIRARD TRUST COMPANY GROUP OF BUILDINGS, PHILA., PA.
Left to right: Morris Building, Girard Trust Co. Building, Girard Trust Office Bldg.

One of the first trust companies in America, organized in 1836 and never merged with any other bank, is the Girard Trust Company.

Carefully conservative in the Girard tradition is the management of the three Girard Trust properties in downtown Philadelphia. Their use of Webster Steam Heating Equipment, goes back to 1910... has kept these properties at the peak in comfort and economy in heating. The 28-story Girard Trust Office Building, the 18-story Morris Building, and the picturesque domed Girard Trust Company Building are today heated from one central boiler plant, with most of the installation enjoying the "controlled-by-the-weather" comfort of a Webster Moderator System.

In 1910, the first installation of Webster Heating Equipment was made in the Morris Building, when the engineering firm of Francis Brothers & Jellett, Inc. (now Stewart A. Jellett Co.) handled the installation of a "Webster System of Steam Circulation and Apparatus."

The Girard Trust Company Building has used Webster Heating Equipment since 1922, when Webster Traps were installed on direct radiation and on vento coils by W. G. Cornell Co., heating contractor.

In 1931, the 28-story Girard Trust Office Building was built and equipped with the Webster Sylphon Traps and Type W Valves. William H. Walters & Sons, Philadelphia, were the heating contractors and Tenney & Ohmes, Inc., New York, consulting engineers.

Webster Heating Equipment has been purchased at intervals for 35 years as made necessary by the changing requirements of these three buildings. Most recent improvement was the selection of a Webster Electronic Moderator System as part of a modernization program begun in 1945 involving a tailor-made orificing job—equipping 734 Radiator Supply Valves with properly sized Webster Metering Orifices. William H. Walters & Sons were the contractors and Moody & Hutchison, Philadelphia, consulting engineers.

Karl Rugart, Philadelphia Representative with Webster for 32 years, has worked closely with the operating personnel of the Girard properties to assure heating comfort, economy and ease of operation. Clarence Morris is Operating Engineer. Warren Moore is Superintendent. S. H. Bigler is Building Manager.

We are ready to work with you as we have worked with the Girard Trust Company.

WARREN WEBSTER & CO., Camden, N. J.
Representatives in principal U. S. Cities :: Est. 1888
In Canada: Darling Brothers, Limited, Montreal

Webster
HEATING SYSTEMS

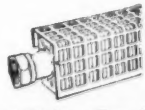
Webster Heating Equipment for Today's New Buildings

Webster Metering Orifices, expertly sized, a vital feature of the Moderator System, balance distribution and make possible central control with continuous heating.

Webster Outdoor Thermostat Control automatically provides the lowest pressure for comfortable inside temperature.

Webster Electronic Moderator Control Cabinet provides continuous heating, always under control.

Webster System Radiation — concealed convectors made of copper tubing and aluminum fins, with *integral* Webster Traps and Valves.



New! Webster Type WI Radiation for installation where floor or wall space is limited.

FOR THE ENGINEER'S BOOKSHELF

BOOKS REVIEWED IN THIS ISSUE

PIPE IN AMERICAN LIFE • ELECTRIC POWER EQUIPMENT
DIRECT AND ALTERNATING CURRENTS • METALLURGY
TRIGONOMETRY REFRESHER FOR TECHNICAL MEN
FUELS, COMBUSTION AND FURNACES • APPLIED ATOMIC POWER
GAS TURBINES AND JET PROPULSION FOR AIRCRAFT
DIESEL OPERATION AND MAINTENANCE
MECHANICS OF MATERIALS • STEAM POWER STATIONS
INDUSTRIAL PEACE AND THE WAGNER ACT • BOOKLETS

Atomic Power

APPLIED ATOMIC POWER. *By Edward S C Smith, A H Fox, R Tom Sawyer and H R Austin.* 227 *pp*, 6x9 *in., illust, cloth.* $4. *Prentice-Hall, Inc, New York, N. Y.*

This very readable nontechnical book should be of great interest to the general public and also to those engineers who seek a little general information regarding radioactive materials, nuclear reactions, history of the atomic bomb, etc. Power engineers will read with particular interest Part IV, "Possible Methods of Converting Atomic Energy into Mechanical Power," by R Tom Sawyer. Mr Sawyer indicates, in a general way, how heat from the uranium pile might be applied to power plants, particularly gas-turbine power plants on land, on shipboard and in locomotives.

Generating Stations

STEAM POWER STATIONS (1946) *Third edition. By Gustaf A Gaffert, mechanical engineer and partner, Sargent and Lundy, Inc, Chicago.* 613 *pp*, 6½x9¼, 400 *illust*, 43 *tables, cloth.* $5.50. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York* 18, *N. Y.*

In keeping with previous editions, the third edition of this well-known textbook confines itself to treating the steam-power stations only. Order of presentation is (1) construction (2) performance characteristics (3) integration of major and minor machinery, largely from a design and construction viewpoint. All the material has been revised and technical information brought up to date.

Specific subject matter covered includes steam engines, steam turbines, condensers, feedwater heaters and evaporators, feedwater treatment, fuels and combustion, steam-generating units, high-pressure and binary-cycle boilers. Further attention is given dust collectors, economizers and air heaters, superheaters and reheaters, fuel-burning equipment, duct work and piping, draft system, coal and ash handling, and pumps. Integration of this equipment is considered under steam-station costs, load curves, plant location, selection of equipment, cycle arrangement, station design.

Combustion Principles

FUELS, COMBUSTION AND FURNACES. *By John Griswold, prof of chemical engrg, University of Texas, Austin, Texas.* 496 *pp*, 6x9 *in., illust, cloth*, $5.50. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York, N. Y.*

Although written specifically for the chemical engineer, as part of the *Chemical Engineering Series*, this text is a welcome addition to the literature of a field rather lacking in up-to-date books of a general nature. As might be expected, the author lays most emphasis on the principles of combustion, on what might be termed its "physical chemistry." For power engineers well grounded in the practice and elementary theory of combustion, this detailed discussion from the chemical engineer's point of view should prove interesting and valuable. On the other hand, the chapters on burners and firing equipment are too limited in scope to be of concern to the power engineer.

The analytical approach of the chapters on combustion again becomes evident in chapters on heat transmission, refractories, furnaces and tube heaters.

The power engineer, who wishes to examine in a more detailed way the variety of reactions involvd in the combustion process, will find this text worth study.

Gas Turbines

GAS TURBINES AND JET PROPULSION FOR AIRCRAFT. *By G Geoffrey Smith, editorial director, "Flight" and "Aircraft Production", London.* 4*th edition*, 246 *pp*, 5½x7½ *in., illust, cloth*, $5. *Aircraft Books Inc*, 370 *Lexington Ave, New York, N. Y.*

To the surprise of many, the gas turbine has had its greatest application thus far in aircraft. With engineering of these units progressing at a rapid rate results are bound to influence other fields. Thus no power engineer interested in gas turbines can afford to overlook aircraft developments.

A relatively easy way to size up the current situation is by reading this new edition of Geoffrey Smith's pioneer book. Enlarged to about three times the size of the first edition, the volume deals first with the basic principles of jet propulsion and with the elements of the gas-turbine plant. It then describes and analyzes the current British, American and German designs, giving detailed specifications, performance characteristics and other data where available. Further chapters deal with jet-propulsion aircraft, combinations of jets and propellers, advanced aircraft types, guided missiles and flying bombs. Reference is also made to closed-cycle gas turbines and to steam-turbine designs proposed for aircraft.

Geoffrey Smith writes in a clear and relatively nontechnical style so that his book is of interest to the tyro as well as the student of this field.

Electric Power Equipment

ELECTRIC POWER EQUIPMENT (1946) 3*rd edition. By J G Tarboux, professor of electrical engineering, Cornell University.* 493 *pp*, 5½x8½ *in.*, 376 *illust*, 21 *tables, cloth.* $6. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York* 18, *N.Y.*

Designed as a reference book for electrical engineers and students, this text covers practically the whole field of electric-power-generating and transmission-line equipment. Starting with a brief survey of power resources, a study of prime movers, the relation of steam to water power, and a discussion of loads and load graphs the book covers generating equipment, synchronous-generator excitation, power-plant layouts, switching equipment, transformers, meters and measurements, switchboards, calculation of short-circuit currents, current-limiting reactors, switches and circuit breakers, transmission lines, relays, lightning arresters, substations, distribution

(*Continued on page* 150)

3-TON
Muntz Metal Tube Sheet to help light Indianapolis

THESE two 6,350-lb. tube sheets, hot rolled by the Detroit Branch of The American Brass Company, recently went into this 30,000-sq. ft. Westinghouse condenser for the Harding Street Plant of the Indianapolis Power and Light Company. These tube sheets are of Anaconda Muntz Metal, 148″ high, 139″ wide and 1¼″ thick. Each is drilled with 5,956 holes—⅞″ diameter.

Anaconda Plates and Circles are accurately alloyed, commercially flat, true to dimensions, uniformly machinable, and unsurpassed in soundness and close-grained structure. Plates for tube sheets are made by this Company in a diversified list of copper alloys in widths up to 156″. Circles can be rolled up to 160″ diameter.

Assistance in selecting Anaconda Alloys, and in meeting specifications for extremely large plates will be furnished by engineers of our Technical Department. 48183

ANACONDA

Anaconda

COPPER & COPPER ALLOYS

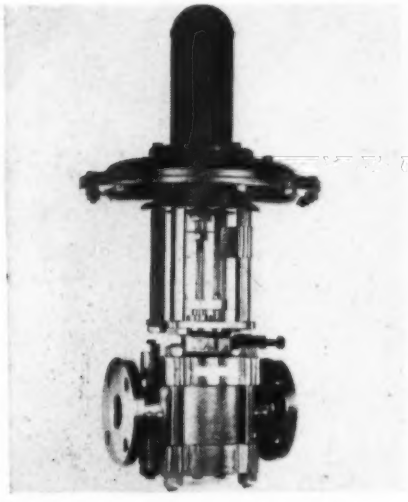
THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

WHAT'S New IN PLANT EQUIPMENT



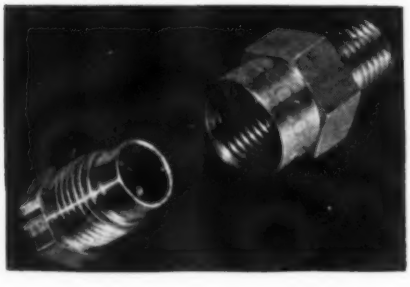
Diaphragm-Motor Valve

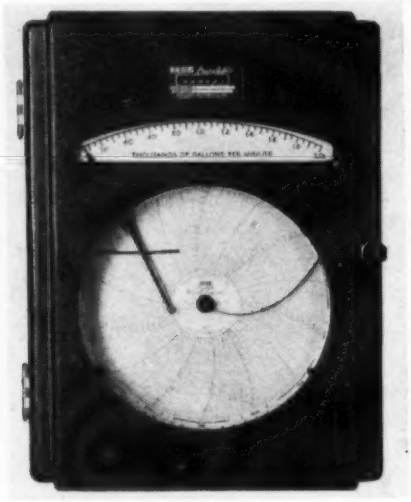
NEW VALVE CONSTRUCTION incorporates a dished bonnet with flush-seated body and through bolts. Body materials, such as iron, bronze, stainless steel, carbon steel, hard lead, hard rubber, monel, nickel, *Hastelloy* and porcelain, are available. Valve is made only for 150-psi service, in sizes of ¼- to 1-in. screwed connections, and 1- to 3-in. with flanges. **Dept 6G, Fischer & Porter Co, Hatboro, Pa.**

Tube Fitting

UNIFLARE FITTING may be used with copper, aluminum, monel, plastic, *Bundyweld* and other varieties of steel tubing within a wide range of wall thickness.

In assembly, plain end tubing is inserted and tube self-extruded and flared by wrench action during makeup. Sizes ⅛ to ¾ in. are available in all commercial shapes. **Dept P, Brockway Co, Naugatuck, Conn.**





Indicator and Recorder

ELECTRICALLY OPERATED secondary instrument, for use with *Propelofio, Shuntflo* or other mechanical flowmeters, can also be used as a recording-indicating totalizing tachometer. Device is actuated by impulses over a 2-wire circuit from a transmitter mechanically driven by primary meter. Primary instrument does not need a power supply.

Transmitter consists of a switch that makes contact for a predetermined number of gallons when they pass through meter. Instrument reads total flow, flow rate and a chart records the flow. Transmission can be from a few feet to many miles. **Dept P, Builders-Providence Inc, Providence, R. I.**

Pipe-Thickness Gage

THIS GAGE measures pipe thickness from the outside. Device consists of an indicating instrument, gage head and saddle. A different saddle is required for each diameter of pipe. In operation, saddle with its gage head is placed on pipe. Thickness is indicated directly in fractions of an inch.

Accuracy of plus or minus $\frac{1}{64}$ in. can be obtained on clean surfaces and $\frac{1}{32}$ in. when surface is dirty. Dirt, scale and paint on inside wall do not interfere with accuracy. **Dept P, General Electric Co, Schenectady, N. Y.**

Pressure Transmitter

TRANSMITTER IS FITTED with an adjustable weighbeam for installations where operating conditions are highly variable or on new processes where flow or pressure conditions may be changed.

Adjustable feature is provided by replacing standard weighbeam with a double beam having a movable pivot between the two halves. Sliding adjustable pivot along a calibrated scale makes a 15-to-1 range change without exchanging parts. **Dept P, Republic Flow Meters Co, 2240 Diversey Parkway, Chicago 47, Ill.**

Fuel Pulverizer

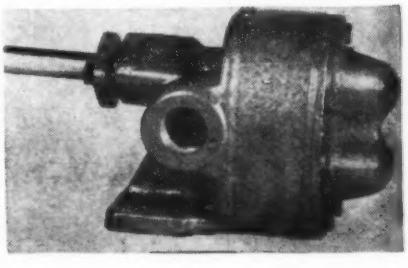
PULVERIZER USES STEAM as activating medium to produce coal so fine that it can be burned with a short flame close to burner, thus permitting use of fireboxes that previously burned only raw coal. Raw coal not larger than ½ in., without preliminary drying, is fed directly to pulverizer.

Fuel feeder is a variable-speed screw that delivers coal into a venturi mouth. A steam nozzle forces coal down into pulverizer onto a protection cover, from which it is projected radially toward outer wall of classifier. From here the coal falls to bottom outlet of pulverization zone in bottom steam-jet block, where it is pulverized by superheated steam from several jets.

From pulverization zone, fuel particles are carried with steam through uptake leg back through classifier where coal that has been pulverized is classified according to size. Coal of about 200 mesh enters outlet chamber of louvers equally spaced around chamber's diameter. Fuel particles are driven out of this chamber to an outlet pipe that leads to burners. Unit is for operation in small space. The 2800-lb-per-hr size requires about 3x5-ft. floor space. **Dept. P, Blaw-Knox Co, Blawnox, Pa.**

General-Service Rotary Pump

LINE OF GENERAL-SERVICE ROTARY PUMPS is available in six sizes and various mountings for capacities up to 51 gpm and 100 psi. Design features include four bearing constructions and special herringbone-gear rotors. Built-in pressure lubrica-



POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P.

All piping equipment for every need ...on one order to CRANE

Yes, sir! . . . one order gets you everything for the job . . . good, dependable material down to the last item. But that's just one way the truly complete Crane line helps to simplify all your piping jobs.

For example, take this **heat reclaim system.** At every step of the installation—from design to erection to maintenance—standardizing on Crane equipment pays big dividends. They're assured by this 3-way advantage—

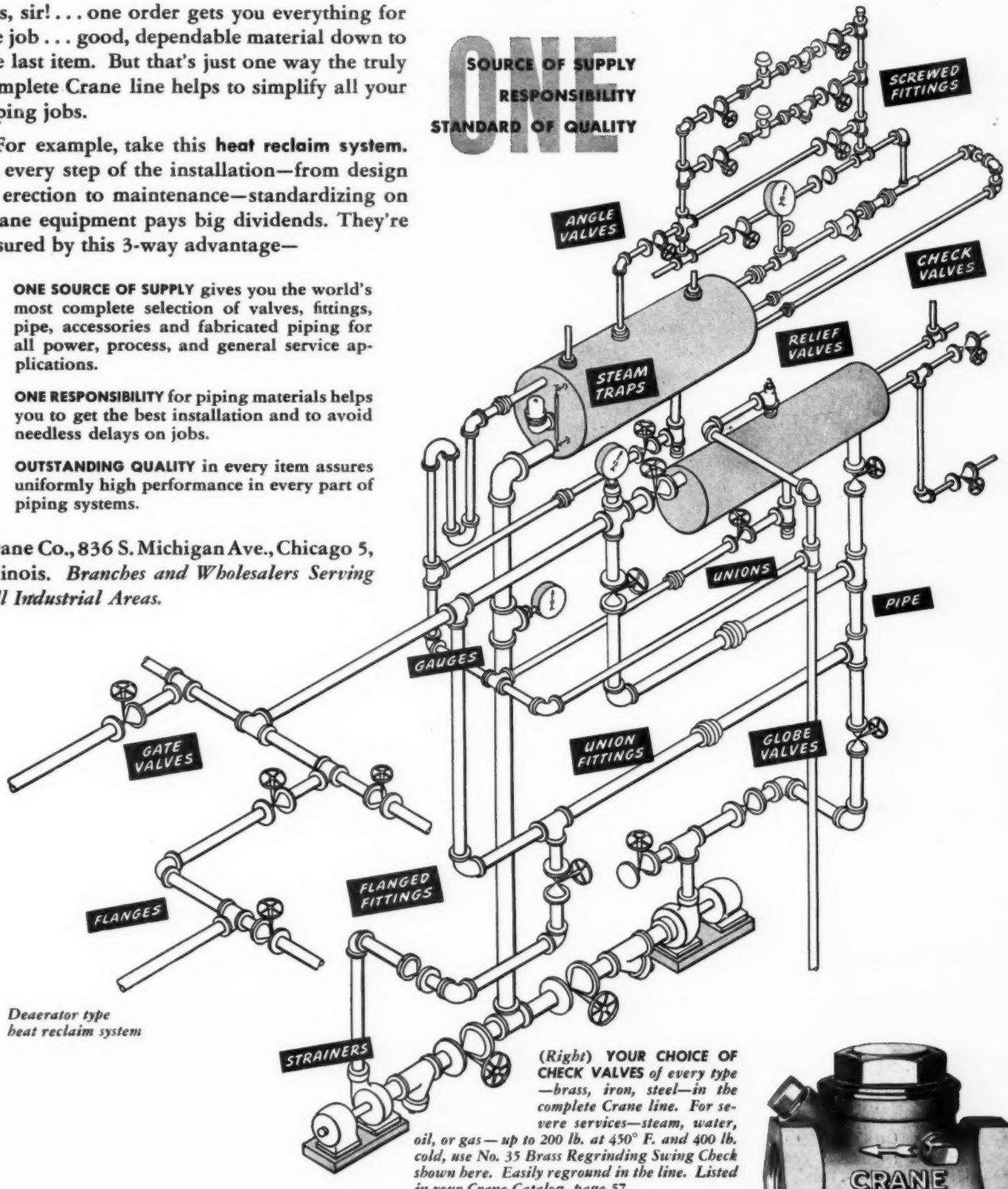
ONE SOURCE OF SUPPLY gives you the world's most complete selection of valves, fittings, pipe, accessories and fabricated piping for all power, process, and general service applications.

ONE RESPONSIBILITY for piping materials helps you to get the best installation and to avoid needless delays on jobs.

OUTSTANDING QUALITY in every item assures uniformly high performance in every part of piping systems.

Crane Co., 836 S. Michigan Ave., Chicago 5, Illinois. *Branches and Wholesalers Serving All Industrial Areas.*

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Deaerator type heat reclaim system

(*Right*) **YOUR CHOICE OF CHECK VALVES** *of every type—brass, iron, steel—in the complete Crane line. For severe services—steam, water, oil, or gas—up to 200 lb. at 450° F. and 400 lb. cold, use No. 35 Brass Regrinding Swing Check shown here. Easily reground in the line. Listed in your Crane Catalog, page 57.*

EVERYTHING FROM . . .

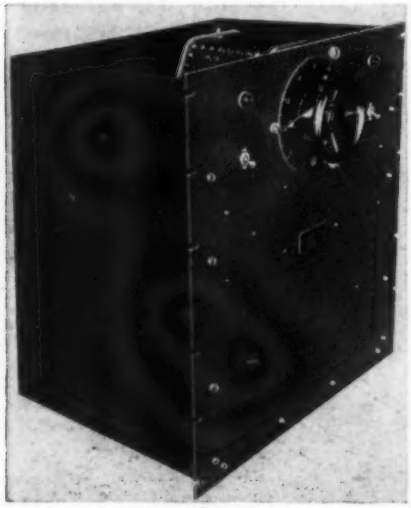
VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

tion eliminates external lubrication and liquid contamination.

Simple design offers easy maintenance and low cost. Foot- or flange-mounted models are available with adjustable stuffing box or mechanical seal, with or without oversize relief valve. All models are suitable for direct-coupling to electric motors and for wide range of industrial applications. **Dept P, Worthington Pump & Machinery Corp, Harrison, N. J.**



Dc Power Supply

WITH A MAXIMUM DC OUTPUT OF 0.5 AMP, *Seco* power supply operates from a 115-v single-phase 50- or 60-cycle source. The power supply uses a full-wave bridge rectifier consisting of four *Type* 866/866A tubes. A time-delay relay allows adequate heating time for filaments before high voltage is applied. Line fuses provide protection against possible overload and all major components are either inclosed in metal or are hermetically sealed. Unit mounts in a standard 19-in. relay rack panel and has an external metering panel. Mounted on power-supply panel is an ac line switch and indicating lamp, high-voltage primary switch with indicating lamp, and a *Powerstat* variable transformer control. **Dept P, Superior Electric Co, 125 Church St, Bristol, Conn.**

Ohm's Law Calculator

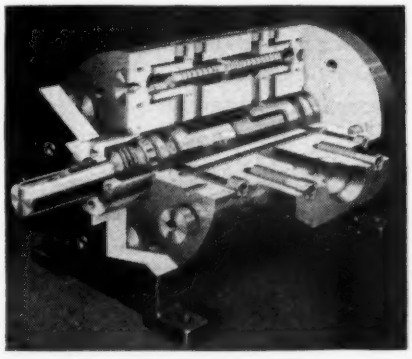
POCKET-SIZE OHM'S-LAW CALCULATOR incorporates a number of new features. It provides a simple and handy means of solving resistance calculation. With one setting of the slide it gives answer to any Ohm's Law problem. All readings are given directly in ohms, volts, amperes and watts. It also solves parallel resistance and series capacitance problems, and will multiply, divide, and find squares and square roots. Its range covers all currents, resistances, voltages and wattages commonly encountered in industrial and radio work.

All computing scales are printed on one side. On opposite side are given composition resistor color code and catalog numbers of stock resistors and rheostats for various resistance values. Calculator is 9x3 in. and is made of heavily varnished cardboard. **Dept P, Ohmite Mfg Co, 4937 Flournoy St, Chicago, Ill.**

Vertical Motor

TRI-CLAD INDUCTION MOTOR GROUP NOW includes a hollow-shaft vertical unit specifically designed for pump drives. This motor is available in ratings from 1 to 500 hp for all speeds and frequencies. It is suitable for irrigation pumps, deep-well turbine pumps, municipal and industrial water-supply projects, mine dewatering pumps and process-industry liquid pumps. The 10-hp and larger motors have a controlled lubrication which allows right amount of oil to flow to bearings and thus prevents oil friction losses caused by foaming and churning. An oil reservoir cast in motor shields has sufficient capacity to allow oil to cool, and also protects bearings by maintaining an oil level above the top of balls. The 7½-hp and smaller units have grease-lubricated bearings.

Motors are cooled by drawing in air at both ends and discharging it through openings in stator frame. A protective "self-release" coupling prevents damage to pump or motor. This coupling consists of a top half keyed to pump shaft, and a lower half keyed to motor shaft. It also reduces installation time and provides a simple method for checking motor alignment. Top cap is easily removed, thus making coupling conveniently accessible. Adjustment of pump shaft is made by a locking nut on top of coupling. Motor can be lined up accurately and easily from the top, and one man can do all the work without aid of rigging. **Dept P, General Electric Co, Schenectady, N. Y.**



Hydraulic Booster

HYDRO-POWER HYDRAULIC PRESSURE BOOSTER is for a variety of applications at pressures up to 7500 psi. A compact multi-plunger intensifier, booster will multiply up to three times pressure of oil it handles in a hydraulic circuit. Power unit includes a cylinder block with six parallel bores, each with a reciprocating, double-action piston.

A central-rotating valve connects piston with pressure-fluid source. As valve rotates, oil connections are made successively to pistons, alternating from one end to the other, to provide uninterrupted pressure flow.

Booster is easily installed in new or old hydraulic circuits. Where higher working stresses are permissible, booster corrects difficulties arising from undersizing the power unit, or from added load. Where intermittently, higher pressures are needed, low-pressure system discharge can be taken through pressure converter and increased up to three times rated pump pressure. Control of this operation may be manual or automatic.

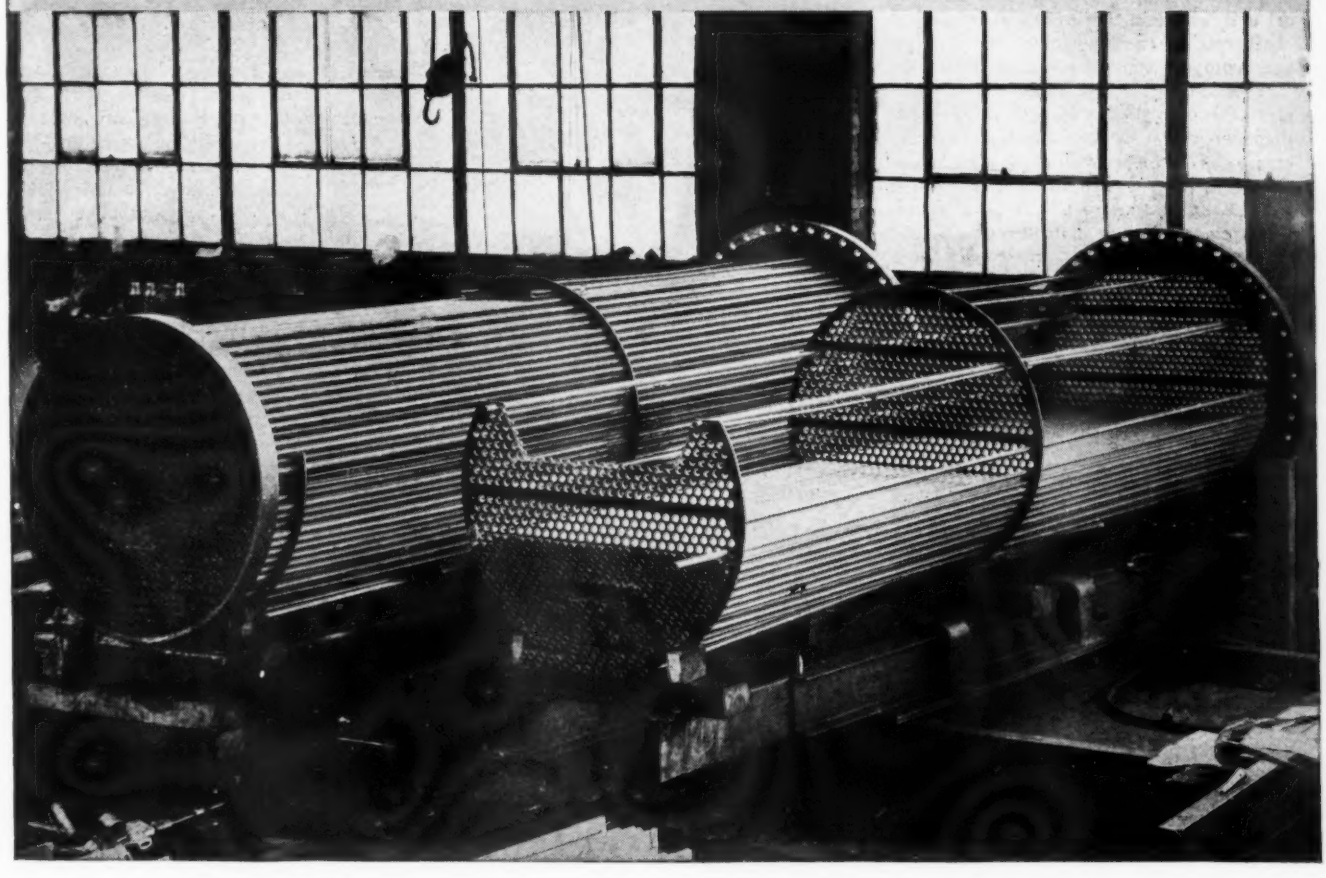
Boosters are built for either 35- or 100-gpm input in two pressure ranges, 2.25 to 1 and 3 to 1. Volumetric output is in inverse proportion to pressure ratio. All units have 7500-psi maximum discharge pressure. **Dept P, Hydro-Power, Inc, Belmont & Sheridan Ave, Springfield, Ohio.**

Speed Selector

VARIABLE-V PLANETARY is a new development of planetary motion in which two V-belts and four variable-pitch sheaves provide any speed from full forward, down through zero, and into full reverse. Variable-V-planetary system compares ratios of

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P.

IT'S IMPORTANT TO KNOW ALL THE FACTORS AFFECTING CONDENSER TUBES



In selecting condenser tubes it is often the case that such conditions as temperatures, pressures, and compositions of the gases and fluids will be taken into account fully, only to have the tubes thus chosen give short service. In such cases, it is wise to call in Revere and ask for a thorough check of the situation before assuming that the wrong alloy was specified.

Here is a case in point. Admiralty tubes in a high stage condenser in a refinery were lasting only three or four months. In the effort to increase life, the sour gas had been treated, but as no improvement was experienced, the treatment was discontinued. The Revere Research report, made after laboratory investigation, stated that Admiralty metal was the correct alloy and its use should be continued, but that microscopic study of a failed tube showed definite and conclusive evidence of fatigue corrosion, probably due to vibration. A conference with the people at the plant revealed that the condenser vibrated considerably. Hence the obvious recommendations: cut down the vibration by better bracing, resume treatment of the gas, and continue to use Admiralty tubes. These recommendations were followed, and when last checked the new Admiralty tubes had been serving for eight months and were still going.

The Revere Technical Advisory Service is eager to serve all users of condenser tubes and plates through close collaboration in the study of difficult problems.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. — Sales Offices in Principal Cities, Distributors Everywhere.

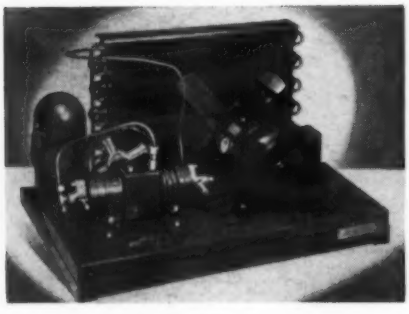
• • •

Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p.m., EST.

two V-belt drives and applies speed difference to output shaft.

When the two ratios are equal speed difference is zero, hence output shaft does not turn. It ratio of one drive is greater than that of the other, output shaft rotates in one direction, at a speed proportional to difference in ratios. When ratio of same drive is less than that of the other, output shaft rotates in opposite direction at a speed proportional to speed-ratio difference.

A hand-control wheel alters pitch diameter of center sheave so that as its pitch diameter increases that of the other decreases. Change in pitch diameter of outer sheave is caused by wedging action of V-belts in its grooves. Thus a handwheel controls pitch diameter of all four sheaves without springs or complex linkages. Ratings are up to 2 hp with output shaft speeds up to 600 rpm, using a 1750-rpm motor. **Dept. P, B F Goodrich Co, Akron, Ohio.**



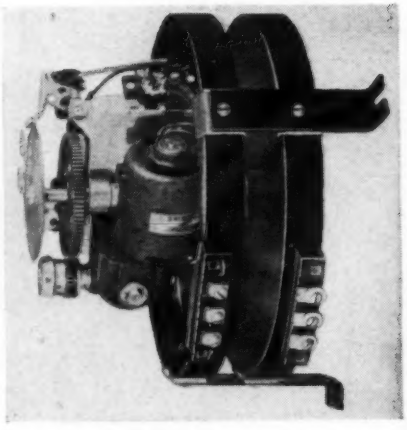
Condensing Unit

NEW ½-hp, 2-stage package-type condensing unit is adaptable for a wide variety of appliances such as frozen-food cabinets, reach-in refrigerators and showcases. **Dept P, Controldtemp Corp, 236 Butler St, Brooklyn 17, N. Y.**

Combustion Controller

PHOTO-CELL DETECTOR receiving a beam of light directed across a boiler breeching acts as a controlling medium for correct combustion, its manufacturer claims. Device works on a smoke-detection principle. An increase in density of smoke beyond a predetermined level across path of light beam actuates the system.

A variable time delay permits selection of a delay interval up to one-half minute. This delay avoids unnecessary system operation from temporary voltage drops or momentary excess-smoke density. A meter indicates smoke density at all times, with a recording attachment available as an auxiliary accessory. **Dept P, Worner Electronic Devices, Rankin, Ill.**



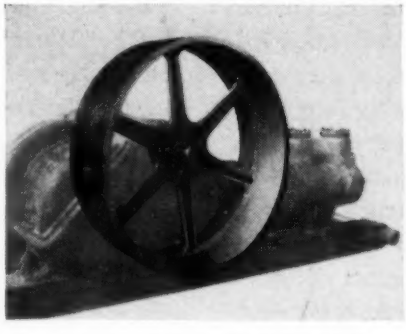
Rheostat Drive

AVAILABLE FOR AC AND DC 150- or 230-v operation, this *Bulletin 60-A* motor-drive unit is suitable for control of 13-in. *SS* rheostats up to three plates. Standard units have 30- or 60-sec travel from resistance-in to resistance-out position, but can be furnished for shorter or longer travel time. Constructed on a 13-in. diameter steel plate, these small motor drives are intended for mounting on extended rheostat feet. They are equipped with adjustable limit switches and a slip clutch for normal operation. A dusttight aluminum cover gives adequate protection. **Dept P, Ward-Leonard Electric Co, 31 South St, Mt. Vernon, N. Y.**

V-Belt Sheaves

LINE OF V-BELT SHEAVES features improved groove-belt fit and reinforced arm construction. Designated as the *A* and *B* lines, each has individual groove size to match belt size; thus, an *A* groove for an *A* belt, and a *B* groove for a *B* belt. Former *A* and *B* combinations of grooved sheaves have been eliminated.

Sheaves have longitudinally ribbed arms recessed down the middle, like I-beam construction, to reinforce them. Material removed at or near the arm's neutral axis, where it contributes little to its strength, is added to zones most remote from neutral axis where it gives greatest strength. **Dept P, Worthington Pump & Machinery Corp, Harrison, N. J.**

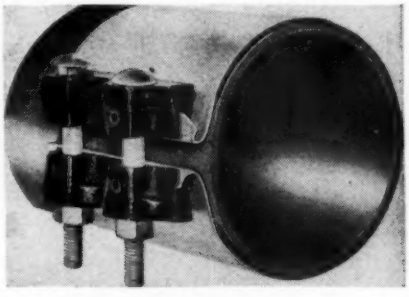


Tube Connector

TUBE-TITE CONNECTOR is made up of aluminum tubing (lengths of 2 to 5 ft) fitted at each end with ¾-in. IPS thread fitting. Tubing is ⅝ in., OD, and connects to fittings by a V-lock seal, which makes a pressure-tight joint. Device is useful wherever connections between apparatus and piping must be broken frequently. **Dept P, Tube-Tite Div, Darra-James Corp, 95 N Main St, Waterbury 14, Conn.**

Wedge-Gate Valves

NEWLY DESIGNED LINE of iron-body wedge-gate valves are for steam pressures at 125 psi and for water, gas and oil pressures up to 200 psi. New features include (1) straight-flow ports (2) end-seated port rings (3) brass gland liner (4) easy-grip handwheel (5) bronze backseat bushing (6) hinged packing-gland eyebolts on *OS&Y* valves. **Dept P, Walworth Co, 60 E 42nd St, New York 17, N. Y.**



Clamp for Pipe Leak

PIPE-LEAK REPAIR CLAMP comes in sizes from ½ to 30 in. in diameter for both metal and asbestos-cement pipe. Clamp uses copper-band sleeve that gives almost 100% wrap-around without using a tongue. Cast lugs can be shortened in even multiples of 3 in. as needed. **Dept P, Smith-Blair, Inc, South San Francisco, Calif.**

Turbine-Driven Heater

NEW HEATER has a steam turbine instead of an electric motor to drive fan. In operation steam from heating system operates the turbine before entering heating element. Special set of tubes cool condensate to 170 F so it can be returned in an open system. **Dept P, L J Wing Mfg Co, 154 W 14th St, New York 11, N. Y.**

Inverted Bucket Trap

SERIES 600 INVERTED-BUCKET TRAP has straight-through pipe connections that permit installation close to floor. All working parts are fastened to bonnet and are

(*Continued on page* 170)

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P

PERMANENT answer for water treatment problems!

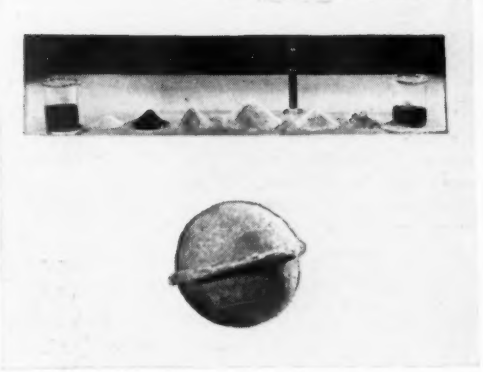
Nalco chemical balls are only one of the many methods used in the Nalco System to provide permanent trouble-free chemical water treatment results. But these chemical balls are typical of the extent to which Nalco has carried research and development toward the goal of perfect water treatment. They are compounded to fit plant operating requirements, and made up in unit weights so that water treatment routine control procedures are made safe and practically foolproof, even with inexperienced help.

Most Nalco System users are old customers—including many of the Nation's leading chemical manufacturers—Another obvious proof of the long-run economy of the complete Nalco System.

A Nalco Survey involves no obligation . . . may provide the permanent answer to *your* water treatment problems. Write today.

NATIONAL ALUMINATE CORPORATION
6222 W. 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to: Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto 8, Ont.



Many ingredients go into Nalco chemical balls... Shown here are typical proportions of ten materials that go to make up the one-pound ball above, compounded to meet predetermined operating conditions.

Nalco

THE SCIENTIFIC SYSTEM OF WATER TREATMENT FOR ALL INDUSTRY

How to Plan an

INDUCED DRAFT COOLING TOWER CIRCUIT FOR CONSTANT TEMPERATURE AND PRESSURE

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

● **In certain processes,** such as cooling of plastic molds, constant temperature is necessary to effect proper results and constant pressure is required to insure constant flow through the cooling circuit. In such cases, a cooling system like the Tower Circuit shown here is preferred to the use of well water or city water, to avoid waste and assure dependable supply.

Constant Temperature of the cooling water is maintained by automatically controlling the amount of warm water pumped from the hot well to the cooling tower. A three-way modulating valve on the warm water pump line to the cooling tower is made responsive to a thermal control point in the suction line from the cold well to the cooling water pump. When regulated, it will divert some of the warm water directly to the cold well. Cooled water from the tower is delivered to the cold well.

Constant Pressure in the circuit is maintained by means of an air cushion in the cooling water tank automatically controlled by an air compressor. This removes from the system all surges resulting from the operation of control valves on the process equipment. Cooling water from the tank is delivered to the equipment and warm water from the equipment returned to the hot well. The cold well has a cold water makeup line to furnish water at all times to the cooling water pump.

Bronze Valves are recommended because they offer the best service under various conditions of city water.

Jenkins PRACTICAL PIPING LAYOUTS 20

Illustrating the proven 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

Fig. 54
Bronze Air Compressor Check Valve
300 lbs. Air Pressure

Other types and pressure ranges of Jenkins Valves can be used for this type of layout according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations. Copies of Layout No. 20 will be furnished on request . . . also future Piping Layouts. Mail coupon.

Fig. 54, a Bronze Air Compressor Check Valve is a dependable means of retaining air pressure where operation is more or less intermittent and customary service conditions prevail. In this valve, the disc is stainless steel, carefully machined, ground and lapped into the seat, insuring tight closure. It is so designed that it can't become dislodged or get out of alignment. The bronze seat ring is renewable.

A CHOICE OF OVER 600 JENKINS VALVES

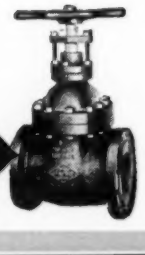
To save time, to simplify planning, to get the advantage of Jenkins specialized valve engineering experience . . . select all the valves you need from the Jenkins Catalog. It's your best assurance of the *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport; Atlanta; Boston; Philadelphia; San Francisco; Chicago; Jenkins Bros., Ltd., Montreal; London, England.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK



125 TO 600 LBS. STEAM PRESSURE

Jenkins Bros

INDUCED DRAFT COOLING TOWER CIRCUIT FOR CONSTANT PRESSURE

INDUCED DRAFT COOLING TOWER CIRCUIT FOR CONSTANT PRESSURE AND TEMPERATURE

Diagram by Hurley Madeheim, Consulting Engineer

VALVE RECOMMENDATIONS
For details . . . and valves to suit varying conditions . . . see Jenkins Catalog.

Code	Quan.	Jenkins Valves	Service
A	2	Fig. 106A Bronze Globe	Pump Discharge Shut off
B	1	Fig. 106A Bronze Globe	Manual Make-up Control
C	2	Fig. 106A Bronze Globe	Manual Control about 3-Way Valve
D	3	Fig. 106A Bronze Globe	Main Control to Equipment
E	1	Fig. 106A Bronze Globe	Cooling Water Shutdown & Control
F	1	Fig. 106A Bronze Globe	Pressure Tank Drain
G	1	Fig. 106A Bronze Globe	Air Compressor Discharge
H	2	Fig. 47 Bronze Gate	3-Way Valve Shut off
J	1	Fig. 47 Bronze Gate	Makeup Water Shut off
K	2	Fig. 352 Bronze Swing Check	Pump Discharge Checks
L	1	Fig. 54 Bronze Check	Air Compressor Discharge
M	3	Fig. 352 Bronze Swing Check	Warm Water Return Checks
N	4	Fig. 743-G Bronze Needle	Pressure Gauge Control
O	1	Fig. 352 Bronze Swing Check	City Water Check

BRONZE • IRON • STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE
SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS BROS., 80 White St., New York 13, N. Y.

Please send me a reprint of Piping Layout No. 20 and future layouts as they become available.

Name.....

Company.....

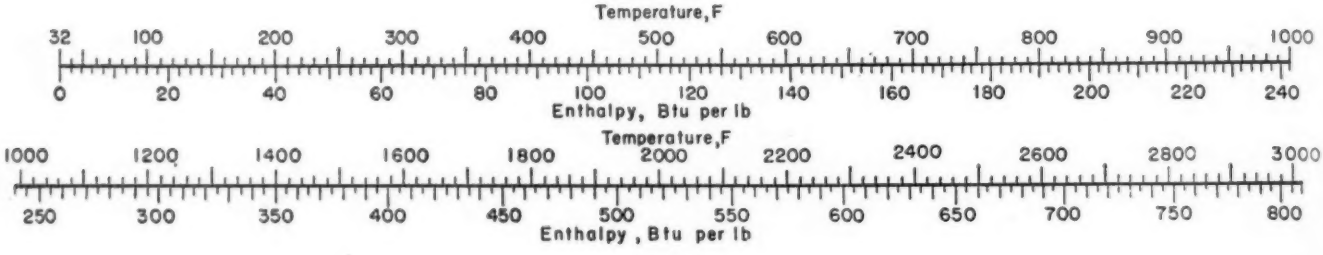
Address.....

Number 175

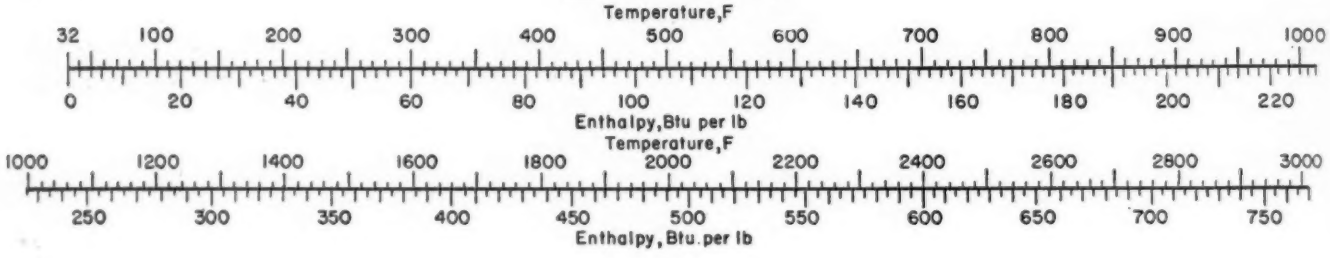
Enthalpy of Gases (at Low Pressure):2

By W M ROHSENOW and D A MOONEY
Massachusetts Institute of Technology

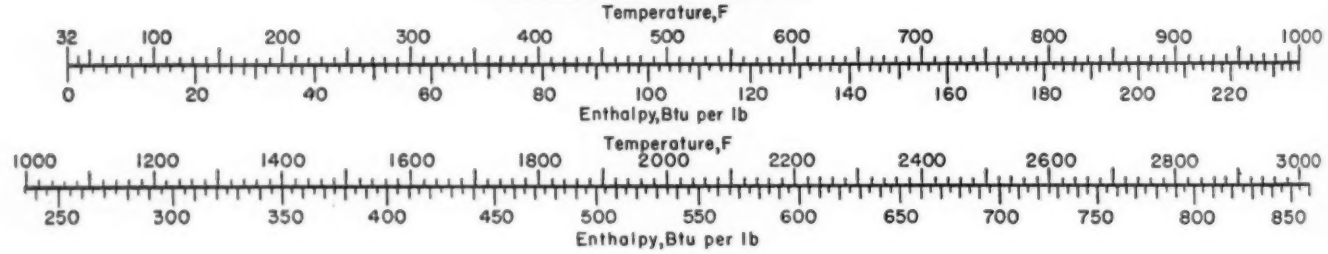
Air



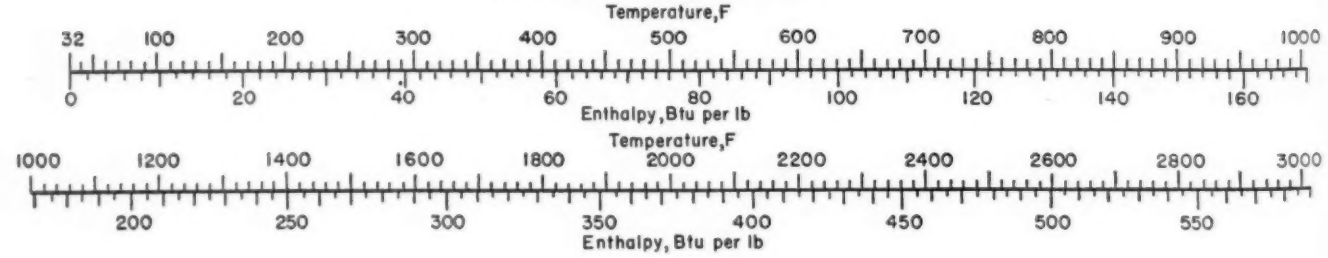
Oxygen (O_2)



Carbon Dioxide (CO_2)

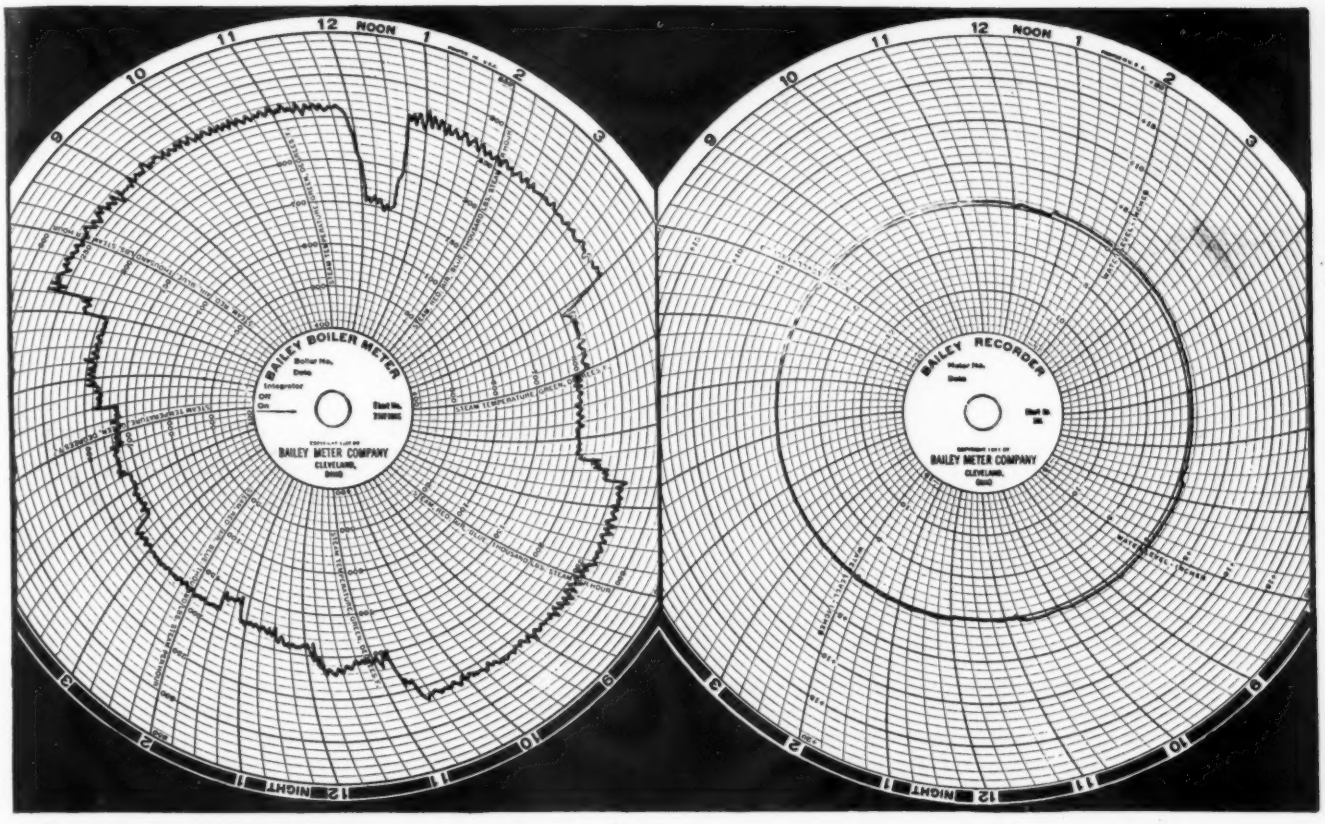


Sulphur Dioxide (SO_2)



Data Sources: Air, O_2, CO_2 — Ellenwood, Kulik & Gay, Cornell Univ Engrg Experiment Station, Bulletin 30, Oct 1942. SO_2 — K K Kelley, Bureau of Mines, Bulletin 406, 1937

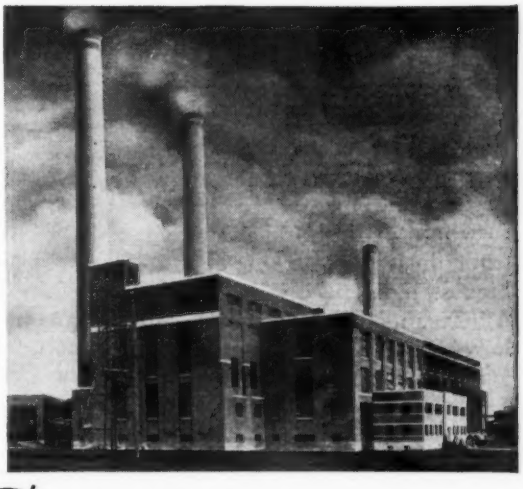
© POWER



COPES AT WESTOVER STATION

OF NEW YORK STATE ELECTRIC AND GAS CORPORATION

Boiler loads at Westover Station at times fluctuate more than you might expect in an 875-psi, 885-F utility installation. Yet COPES Flowmatic closely stabilizes boiler water level, as shown by the charts, on the two Foster Wheeler three-drum, bent-tube steam generators. Except for shrink and swell, the level is held within one inch by two-element COPES Control. The story is told in Bulletin 463—Boiler Feed Control at Westover, Greenidge and Jennison Stations. Write—your letterhead, please—for this 16-page report.



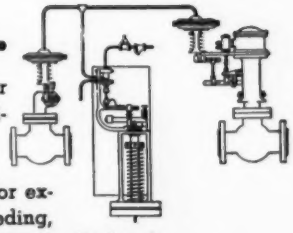
NORTHERN EQUIPMENT COMPANY
371 GROVE DRIVE, ERIE, PENNSYLVANIA
Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters
BRANCH PLANTS: Canada, England, France • *Representatives Everywhere*

★ GET CLOSER LEVEL CONTROL WITH COPES FLOWMATIC

DESUPERHEATER...

Here's a desuperheater every bit as effective on light loads as at full capacity. No water dribbles into the steam line. There is complete atomization of the cooling water from zero to full load because the opening of the spray nozzle—not the pressure drop across it—is varied with steam temperature. A self-contained unit, as *dependable* as the COPES Feed Water Regulator. Write for Bulletin 405-A.

MASTER CONTROL...



Remote control of reduced water or steam pressures, with single or multiple pressure reducing stations, is *dependably* accurate with the COPES Master Control. Adapted for excess pressure control in boiler feeding, where one or more turbine-driven pumps discharge into a common water header. Details on request.

Class Struggle Isn't the Answer

Condensed from a letter recently sent to all members of the Watch Workers Union by Walter W Cenerazzo. Reprinted by permission from Dec 1946 *Reader's Digest*

DEAR FELLOW MEMBERS:

This is going to be tough. Some of you may get sore. But I'm a "labor leader." And what sort of "leader" would I be if I didn't tell you what I see ahead? So here it comes, straight:

Now's the time when you've got to work with everything you have. You've got to produce and produce and produce. So must all other American union workers. We've been pushing our wages up and up and up. Fine. But if we put our wages up on stilts and don't lift our production up to the level of the stilts, it won't be long before the whole country goes from the stilts to the skids.

Capital and management can absorb wages up to a point and still reduce costs, reduce prices, increase sales and spread prosperity. But now we've raised wages to where capital and management can't do it alone. Now comes the biggest moment in the history of American labor. Now the unions have got to help capital and management carry the load of more goods, more services and more welfare for the American people.

Look at our gains in all three companies in our industry. Since 1941 we have had large increases in wages at Hamilton, Elgin and Waltham. And we've had no strikes. You've had other gains, too: paid holidays, paid vacations, sickness and accident benefits, pensions, better-aired and better-lighted workrooms—all adding up to higher costs for your employers.

Best of all, you have new dignity and security. You can't be fired now except for just cause, subject to review and arbitration. And our union has security, too.

A few years ago our employers had it all their own way. Now the pendulum has swung toward us. Are we now going to be as unfair to our employers as they once were to us? Or are we going to show some sense? Not for their sake, but for our own? Because, listen:

Sales make wages. Production makes sales, and low-cost low-price production makes more sales. In the last year our employers have put out more money on payrolls and tools than they have taken in out of sales. In the last 20 years their average profit per watch has been less than a dollar. Profits are necessary. Only out of profits can our employers give us better tools for better production, out of which we can get our cut in bigger wages.

We've got to help our employers make good profits.

Some guys will yell: "So, you're 'company minded.'" Sure, I'm "company-minded." I'm "union-minded" too. A man who is only "company-minded" and who can't see the union except as something to fight is a class-struggle man; a man who is only "union-minded" and who can't see the company except as something to plunder is a class-struggle man. To prevent the class-struggle from wrecking the country, America must be "union-minded" and "company-minded" both.

I think management has only a half-mind and labor has only a half-mind till they come together to make one complete American mind. With its half-mind management gives us new machines and smart new methods. But then it will often act as if it loved machines and methods and hated people. It will see some little guy piling up a bit of extra money because of his piece rate on a new, faster machine, and it will cut the rate back till he's right where he was before, with not one new cent for his family.

So he gets wise; next time he sees a new machine he won't make it do its best. That kind of showdown has cost America billions of dollars in new wealth and welfare. And management can blame itself for that.

But now comes the other half-mind, the union. Its first job is to increase take-home pay. We've done it. But then a union can go crazy. It can try to resist new machines and new methods. Or it can have sense. Our union has had sense.

One of our recent contracts says that the company "recognizes that its employees shall be compensated at as high a wage level as the company's financial condition permits." But it says also that "in order to be kept alive this company must be alert to the technological changes which occur within the industry." And it says that "operations must be carried on at the maximum of efficiency."

I'm proud of this, but how could we afford to say it? Because in our contracts we also say: If the company thinks your piece rate should be cut, you can submit the new rate to the grievance procedure between the company and the union and have it negotiated and adjusted.

(*Continued on page* 142)

. . . the skill of the J-M Insulation Applicator makes the difference!

Only when it's properly applied can even the finest insulation provide maximum fuel savings and operating efficiency.

The right insulation for every application

Your J-M Insulation Applicator selects the right materials for your job from the wide variety in the J-M industrial insulation line (for temperatures from 400° F below zero to 2,800° F above).

Johns-Manville Insulation specialists, plus the facilities of the J-M Research Laboratory, are available to help you with your particular insulation problems, regardless of how complex they might be.

Expert application of the right insulation

J-M Insulation Applicators offer this double assurance of a completely efficient job: (1) They are trained in all phases of insulation application. (2) They employ skilled mechanics and the most up-to-date methods of application.

For further details, write your nearest J-M Insulation Applicator or Johns-Manville, Box 290, New York 16, N.Y.

JOHNS-MANVILLE *First in* INSULATIONS

You can now look "technological progress" in the face and not be afraid of it. The rights of machines and methods and the rights of people have met and mingled. They should get joined together in every factory in America. Unions could then stop being just fighting outfits. They could become the active partners of management for more and more productivity and prosperity. And what an America we could have if free managers and free unafraid workers in every workplace were coöperative with one complete mind!

Every industrial engineer will tell you that there never yet has been a factory in America that came within hailing distance of its fullest possible production. And it never will without *you* and *you* and *you*. You can see things that management can't see. You can see the little wastes that add up to one great big terrible waste. Management can't stop them. You can. You can help your union to show management that we are contributing to the company's kitty—the kitty for the stockholders, for management, for your own next wage-hike.

Some managements don't want any help from unions. They refuse it when it is offered. They are stuffed shirts who would rather lose money for their stockholders than lose the stuffing out of their shirts. Thank God our employers are down on the ground and on the level. They welcome our help. Give it to them. They need it right now!

During the war we made no civilian watches. We made only precision instruments for the armed forces. And during the war 28,000,000 Swiss watches came into this country. We surrendered the whole American watch market to the Swiss.

The biggest prewar year for watches was 1929, when we and the Swiss together sold 5,100,000 watches in the United States. And this year our Government has agreed to allow 9,200,000 Swiss watches to come into the United States. The Swiss are skillful, economical, scientific. They can produce. They have the highest wages on the European continent, yet they are producing at less than half our wages. Some competition!

Before the war we had 50 percent of the American market. Now we have only 25. We've got to produce now or perish.

But we're not the only ones in that boat. Our Government is pledged to reduce all international trade barriers, including our own. We're going to export more; and, to balance it, we're going to import more. We're going to have "One World." Wonderful! I hope it means peace. But I want to tell millions of our fellow unionists in all sorts of industries:

It also means the fiercest competition you ever saw; and you're going to get up on your toes now or lose your jobs.

Your employers better come to you and ask your help, or you'd better go to them and make them take it.

A lot of unionists may say: "We're not in an industry that has imports. We're in an industry that produces exports." Yes? Then watch those British! They're making better stuff every minute, and they're going to try to sell in every country where we sell. Furthermore, we've pushed our wages up to where they absolutely can undersell us, unless to our increases of wages we unionists add some increases of brains.

American free enterprise now has to be saved by unions as well as by managements. Our foreign competition is more and more socialistic. In this new "One World" we Americans are representing real free enterprise almost alone.

Do you want to save it? Are you going to produce? You can say "*No.*" This is a free country. The Russian workers can't say "*No*"! They produce when they are told to and for as long as they are told to. You, my fellow unionists, now have the fate of American free enterprise in your own free hands.

Every day every unionist in his workplace is helping to decide between Americanism and totalitarianism. Every day, every hour, every littlest girl at the smallest machine casts her vote in that great election.

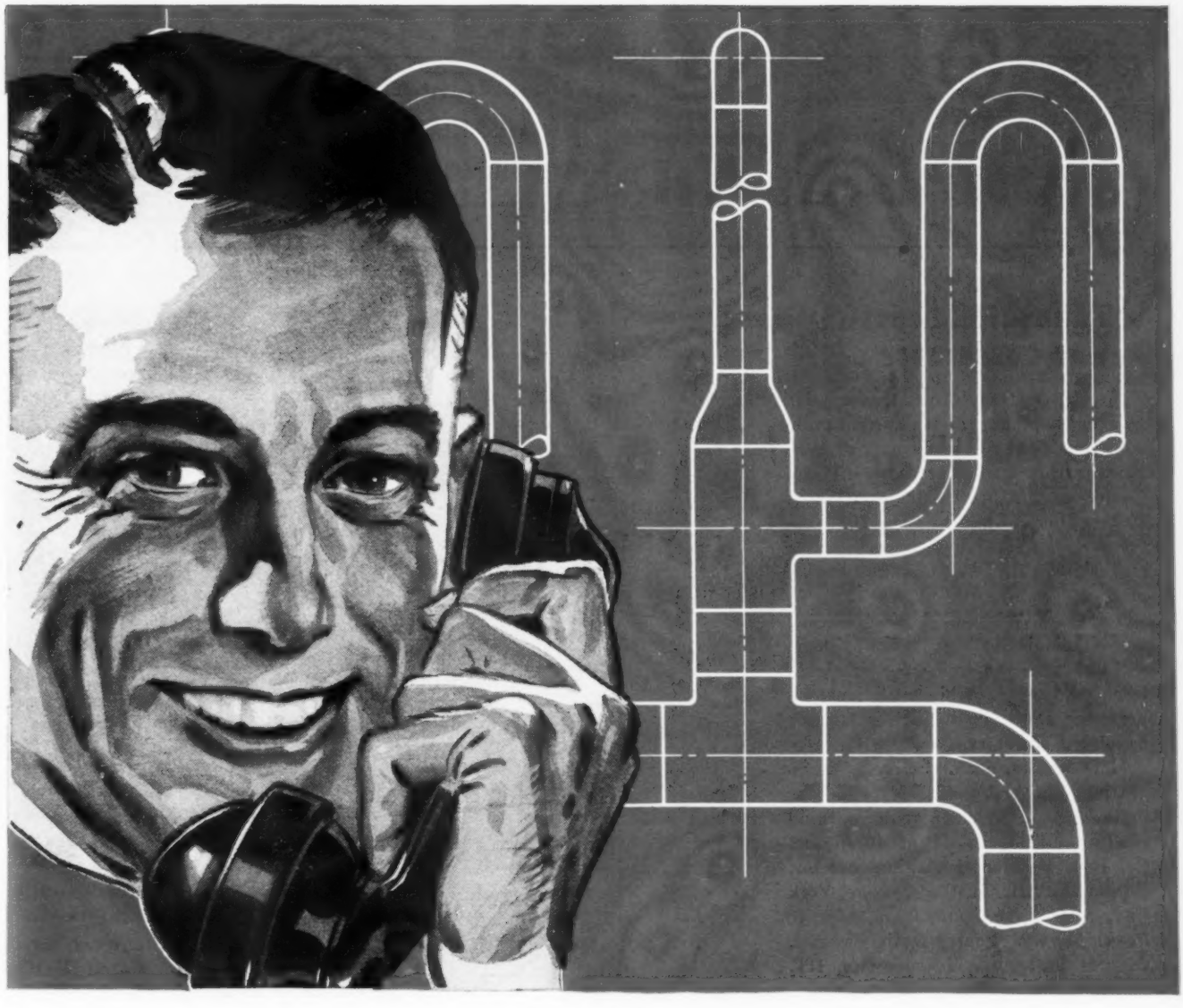
You know our union is already headed the right way. We're for free enterprise, and our employers know it. We allow no Communists to hold office in our union. And we've got only a few screwballs who get any kick out of shouting, "To hell with the boss." The other day at Elgin we unanimously passed a resolution saying, "We're proud to work at Elgin Watch." I think I ought to give the president of Elgin a button to wear saying, "I'm proud of the Watch Workers Union." And I'd like you to tell me to tell him something like this:

We members of the Watch Workers Union are for the stockholders. We're for the managements. We're for labor. We've got our new rights. We're going to use them. We've got our new duties. We're going to do them. We're going to start a friendly rivalry with you. We're going to try to do as much as you do, and even more than you do, for the quality and quantity of Walthams, Elgins and Hamiltons. We're going to make labor a positive creative force in our part of America.

Mr Cenerazzo's letter makes more sense than anything I have seen recently on the responsibilities of management and labor. That's why I asked the Editors of POWER to reprint it on my page.

George Edwards

Engineer



"3½% Nickel? – Yes Sir!"

MODERN piping engineering calls for the use of more and more special steels and alloys in welded lines. Demands for welding fittings to meet these new requirements are being filled more and more promptly thru the Tube Turns distributor.

He represents a really complete line of welding fittings, and flanges. A line which includes more than 4000 items in carbon steel and also a wide range of special metals and alloys—stainless steel, wrought iron, copper, aluminum, monel metal, inconel, nickel, carbon moly, chrome moly, brass.

Write for the name of your nearest Tube Turns distributor and facts about how *the fittings that become part of the pipe* serve others in your industry.

TUBE TURNS (INC.), LOUISVILLE 1, KENTUCKY

District Offices at New York, Washington, D. C., Philadelphia, Pittsburgh, Detroit, Chicago, Houston, San Francisco, Los Angeles

TUBE-TURN TRADE MARK **tt** ***Welding Fittings and Flanges***

ONE SOURCE OF SUPPLY FOR ALL WELDING FITTING REQUIREMENTS

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

9th Annual Midwest Power Conference

► POWER, ITS PRODUCTION, transmission and consumption, with the current problems and recent developments of each phase, will be studied at Midwest Power Conference on March 31—April 2 at Palmer House, Chicago. The 1947 conference, sponsored by Illinois Institute of Technology, will be the ninth annual meeting.

Stanton E Winston, dean of evening div of Illinois Institute of Technology, will direct the conference for his eighth term. Edwin A Whitehead, research professor at the institute, is the newly appointed secretary.

M O Withey, dean, College of Engineering, University of Wis., will give the address of welcome at the opening meeting on March 31 at 10:15 am. Col H S Bennion, managing director, Edison Electric Institute, New York City, will discuss *Trends in Electric Power Supply*. Pearce Davis, director, dept of business and economics, IIT, will talk on *The Economic Situation of the Present, and What It Presages for the Future*. Robley Winfrey, research professor, Iowa State College, will speak on *Depreciation Rates*.

(*Continued on page* 186)

COMING EVENTS

Mar 17-19—Chicago Production Show, Stevens Hotel, Chicago, Ill. Chicago Technical Societies Council, 55 W Jackson Blvd, Chicago 4, Ill. Dates correspond with 3-day conference of 48 affiliated technical societies.

Mar 22-27—Fifth Western Metal Congress & Exposition, Civic Auditoriums, Oakland, Calif. W H Eisenman, secretary, American Society for Metals, 7301 Euclid Ave, Cleveland 3.

Mar 25-28—Seventeenth Annual Safety Convention & Exposition, Hotel Pennsylvania, New York, N. Y. William F Brown, general chairman, Greater New York Safety Council, 60 E 42nd St, New York 17, N. Y.

Mar 31-Apr 2—Midwest Power Conference, Palmer House, Chicago, Ill. Stanton E Winston, director, Illinois Institute of Technology, 41 W 33rd St, Chicago, Illinois.

Apr 7-10—Corrosion Engineers' Convention, Palmer House, Chicago, Ill. A B Campbell, executive secretary, National Association of Corrosion Engineers, 905 Southern Standard Bldg, Houston 2, Tex.

Apr 11-12—New Jersey Society of Professional Engineers, Essex House, Newark, N. J. Charles J Dodge, managing director, 86 E State St, Trenton, New Jersey.

Apr 14-17—Southern Machinery & Metals Exposition, Municipal Auditorium, Atlanta, Ga. Michael F Wiedl Jr, managing director, P O Box 4687, Atlanta 2, Ga.

Underground Coal Gasification in Ala.

Alabama Power Co, with Bureau of Mines cooperating, is experimenting with underground gasification of coal for conversion to power at the Gorgas, Ala., plant. A blower (*foreground of photo*) supplies 10,000 cu ft of air a min for burning of the coal. Boiler (*at left*) supplies steam for production of water gas.

Site of the experiment is a small neck of land jutting out from a larger hill chain. A bulldozed, cutoff trench isolates the 400-ft-long 300-ft-wide section of land from the rest of the hill. The coal vein within this section is 30

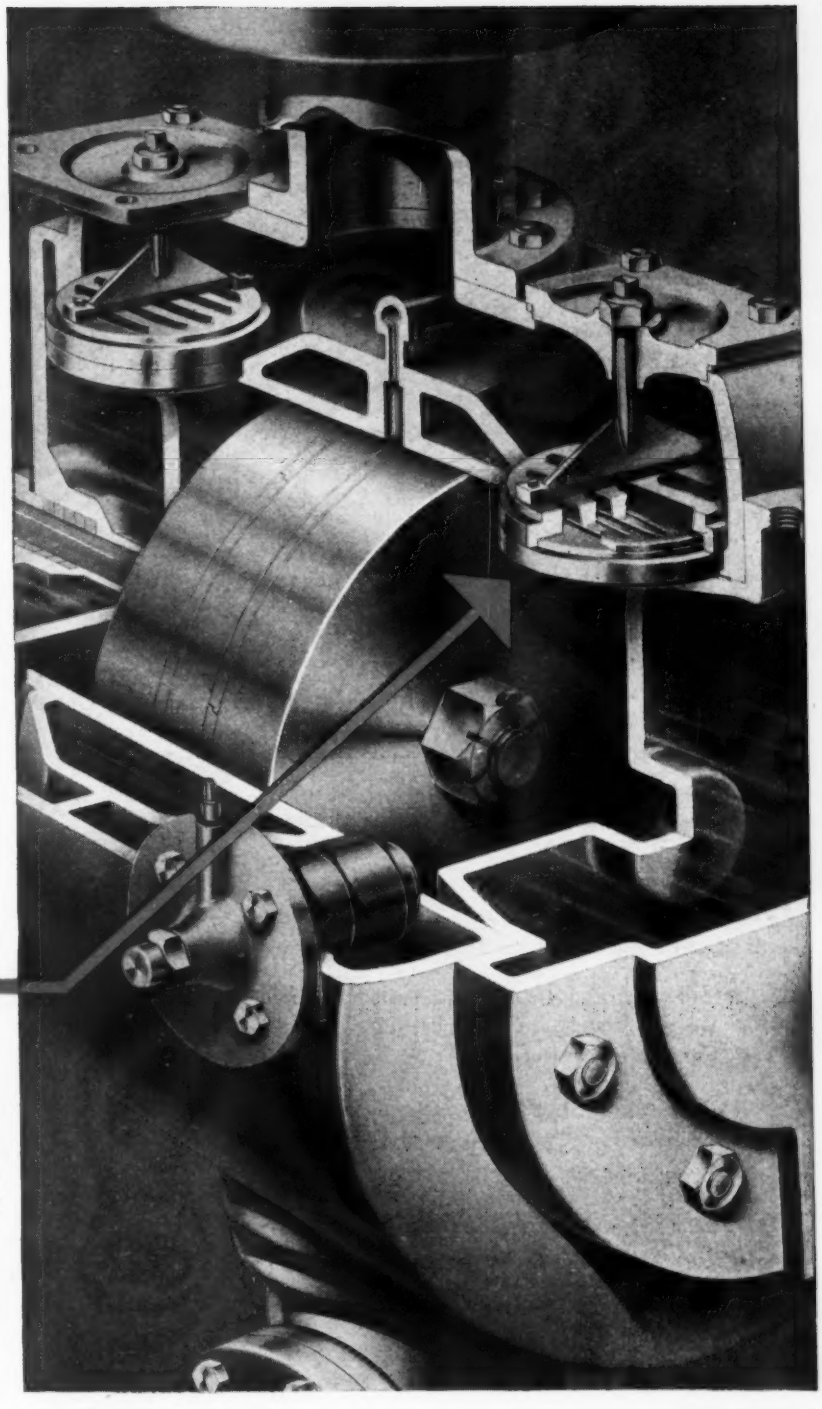
(*Continued on page* 192)

Inside Knowledge on Lubrication Problems

—VALVE DEPOSITS—

This is One of a Series of Messages on Common Problems in Your Plant

No Place for Deposits



HERE'S A SPOT in your plant where freedom from deposits pays. It's the discharge valve of your air compressor.

Hot compressed air, rushing through this valve, attacks the lubricating oil. Unless the oil resists oxidation under the extreme heat, you get hard carbon deposits that clog the valve, cause air leakage and loss of efficiency.

The proved solution to this problem is Gargoyle D. T. E. Oil, now in use in thousands of air compressors all over the world. This famous oil possesses exceptional chemical stability to reduce deposits to a minimum. It forms strong films to protect vital parts against wear.

With this oil in your compressor, your valves stay clean longer. You can maintain air compression at capacity levels with minimum time lost for maintenance.

SOCONY-VACUUM OIL CO., INC.
and Affiliates: Magnolia Petroleum Company
General Petroleum Corporation

GARGOYLE Lubricants

SOCONY-VACUUM

TUNE IN THE MOBILGAS PROGRAM — MONDAY EVENINGS, 9:30 E.S.T. — NBC

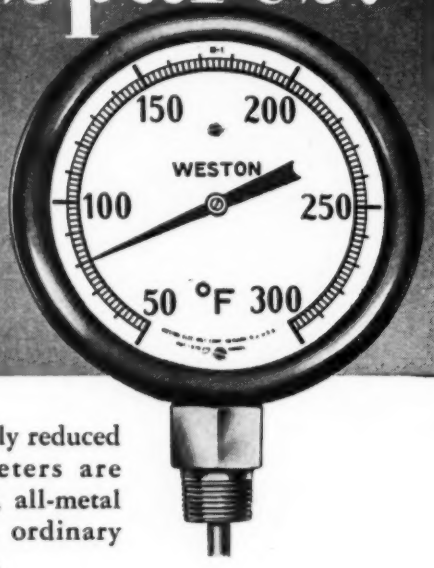
Socony-Vacuum Correct Lubrication

FOR EVERY MACHINE . . . EVERY OPERATING CONDITION

FEWER CARES!

Fewer Spares!

WITH
WESTON
all-metal
THERMOMETERS



Replacement costs are materially reduced when WESTON thermometers are adopted because their rugged, all-metal construction eliminates the ordinary causes of thermometer failures.

- Sturdy all-metal construction provides unusual resistance to vibration, shock or mechanical abuse.
- Absence of capillaries, gases, liquids or involved mechanisms, eliminates breakdowns.

Weston All-Metal Industrial Thermometers are available from stock in types, sizes and ranges for most applications, with stem lengths from 2½" to 48". If your jobber cannot supply you, see your local WESTON representative, or write for Thermometer Bulletin . . . Weston Electrical Instrument Corporation, Frelinghuysen Avenue, Newark 5, New Jersey.

MAX-MIN models also available to indicate highest or lowest temperature reached.

Weston *Instruments*

Fan Installation

(*Continued from page* 87)

readings, while the fan runs, indicating the angles and amount of vibration on each bearing. A second set of readings is taken subsequent to placing a trial weight on one side of the rotor. Then the weight is shifted to the other side, and a third set of readings recorded. With these data vector-diagram calculations are made to determine the location and amount of weight to add.

Other types of portable instruments use a neon bulb. These give location of the weight to be added, but not the amount.

Here are tips useful in balancing work: (1) Rotate a fan rotor when it is in hot gas to keep the shaft from sagging. (2) When electrically welding balance weights on fan rotors, be sure to ground rotor to fan casing to prevent arcing from pitting the bearings.

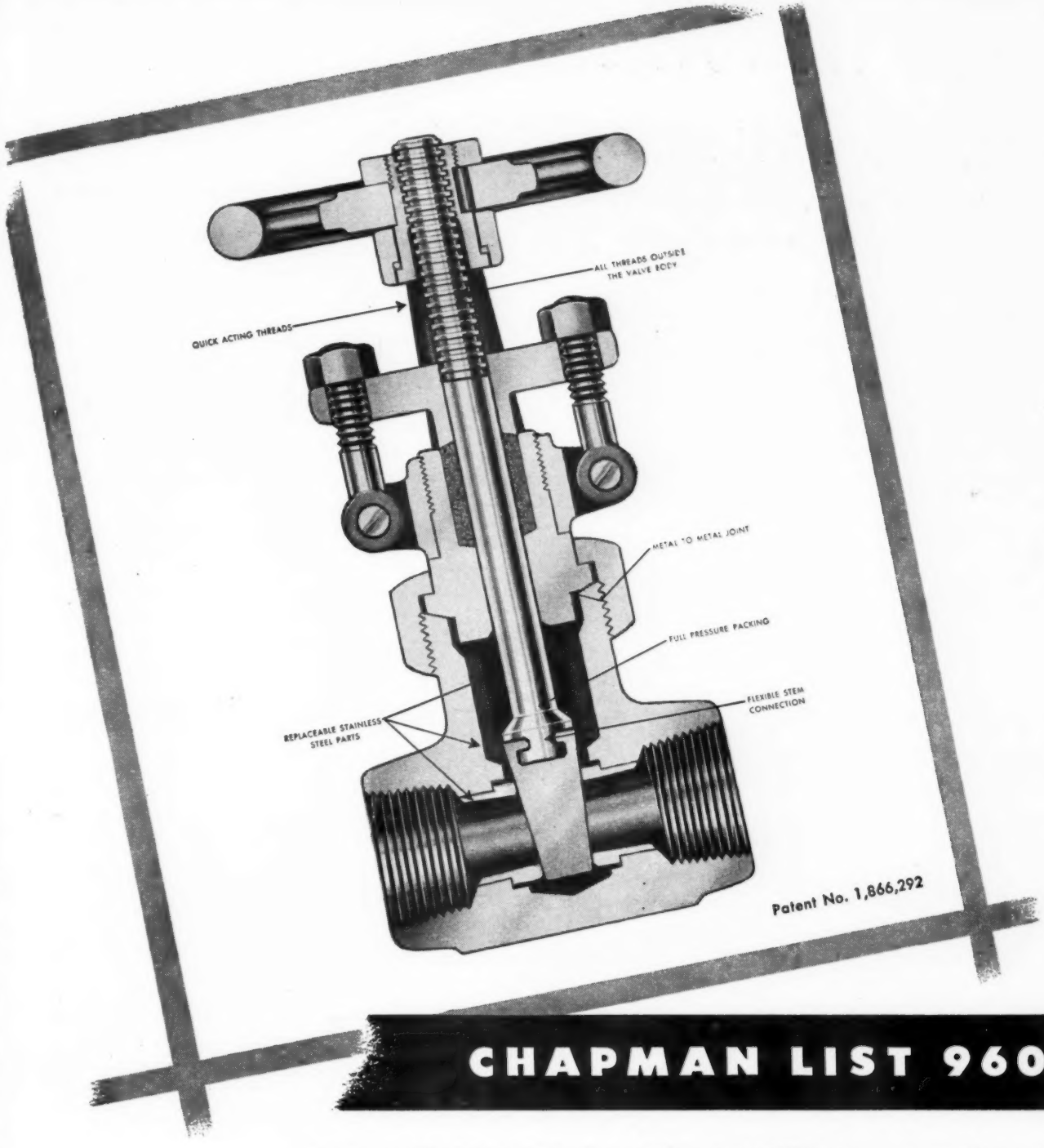
Centrifugal Pumps

(*Continued from page* 73)

cial design because there is no danger of losing prime in the others. Therefore, the efficiency loss because of the special first stage is a smaller part of the over-all loss than in a single-stage design.

So far, only relative sizes and efficiencies for different specific speeds have been discussed. Other important changes are brought out in the head-capacity and the brake-horsepower curves, Fig. 8 and 9, which are plotted in percentages of normal values. At the low specific speed of 1000, Fig. 8, the head-capacity curve is practically flat between shutoff and best efficiency, which is at 100% capacity. The curve may have a strong tendency to droop, but for higher specific speeds, shutoff head rises until with propeller pumps it may be three times that of normal, as indicated by the curve for 9200 specific speed.

Change in the brake-horsepower curves is even more pronounced, Fig. 9. For low specific speeds (for example, 1000) horsepower increases continuously with capacity, so that motor size is determined by the greatest capacity to be pumped. At higher specific speeds (2800) the curve flattens out so, regardless of capacity, the motor cannot be overloaded. With still



CHAPMAN LIST 960

A Small Gate Valve That Will Stay on the Job

Here is a compact forged steel gate valve so ruggedly built that it practically eliminates the maintenance and replacement problem. Because no pressure is transmitted to the stem, it can be repacked under full pressure. Its quick-acting threads will not stick or freeze. It is supplied with super-hardened seats and plugs for extra severe services.

Made in sizes from ¼" to 2"— carbon steel for pressures to 800 pounds; alloy steels for pressures to 1000 pounds at 750° F. For higher pressures, specify List 990.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

Reduce THE COST OF STEAM

Increase BOILER CAPACITY

Also Improve Operating Efficiency of Steam Processing Units and Reduce Maintenance of Boilers and Steam Lines

An Ohio tomato products plant reports: Tomatoes handled daily, 100 tons. Before installation of Stickle Differential Drainage and Boiler Return System, boilers used 10 tons of coal a day, requiring four firemen. With system, coal consumption about five tons a day, two firemen required, and condensate pumped back to boilers at 325°. Before installation of system, cooking time for puree ran as high as 35 minutes. With system, raw tomato pulp reduced to 1.05 specific gravity in nine minutes with 100 lbs. boiler pressure.

The Stickle System returns condensate to boilers, under pressure, at a temperature only a few degrees below temperature of steam at operating pressure, assures complete drainage efficiency and maximum performance from processing units, eliminates high velocities, and reduces boiler scale. Minimum results are computed in advance—*and guaranteed.* Ask for Bulletin No. 250.

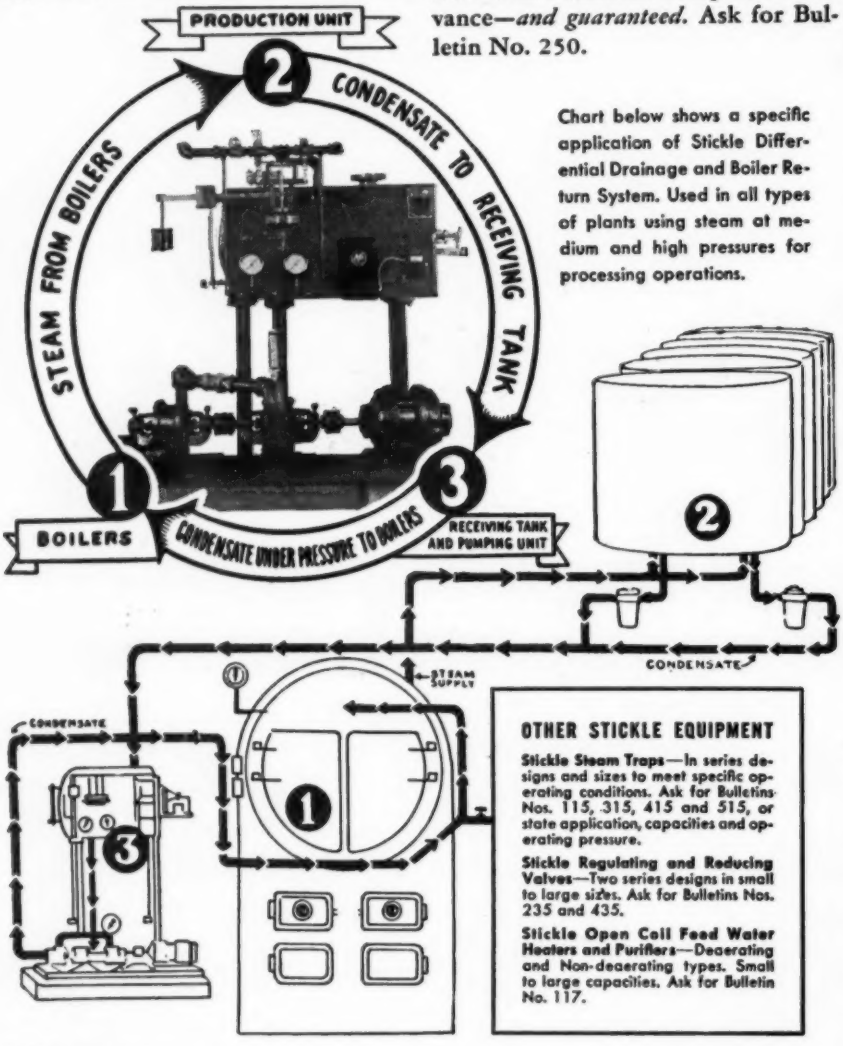


Chart below shows a specific application of Stickle Differential Drainage and Boiler Return System. Used in all types of plants using steam at medium and high pressures for processing operations.

OTHER STICKLE EQUIPMENT

Stickle Steam Traps—In series designs and sizes to meet specific operating conditions. Ask for Bulletins Nos. 115, 315, 415 and 515, or state application, capacities and operating pressure.

Stickle Regulating and Reducing Valves—Two series designs in small to large sizes. Ask for Bulletins Nos. 235 and 435.

Stickle Open Coil Feed Water Heaters and Purifiers—Deaerating and Non-deaerating types. Small to large capacities. Ask for Bulletin No. 117.

STICKLE STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE, INDIANAPOLIS 1, INDIANA

SPECIALIZING FOR MORE THAN 40 YEARS IN REDUCING THE COST OF STEAM

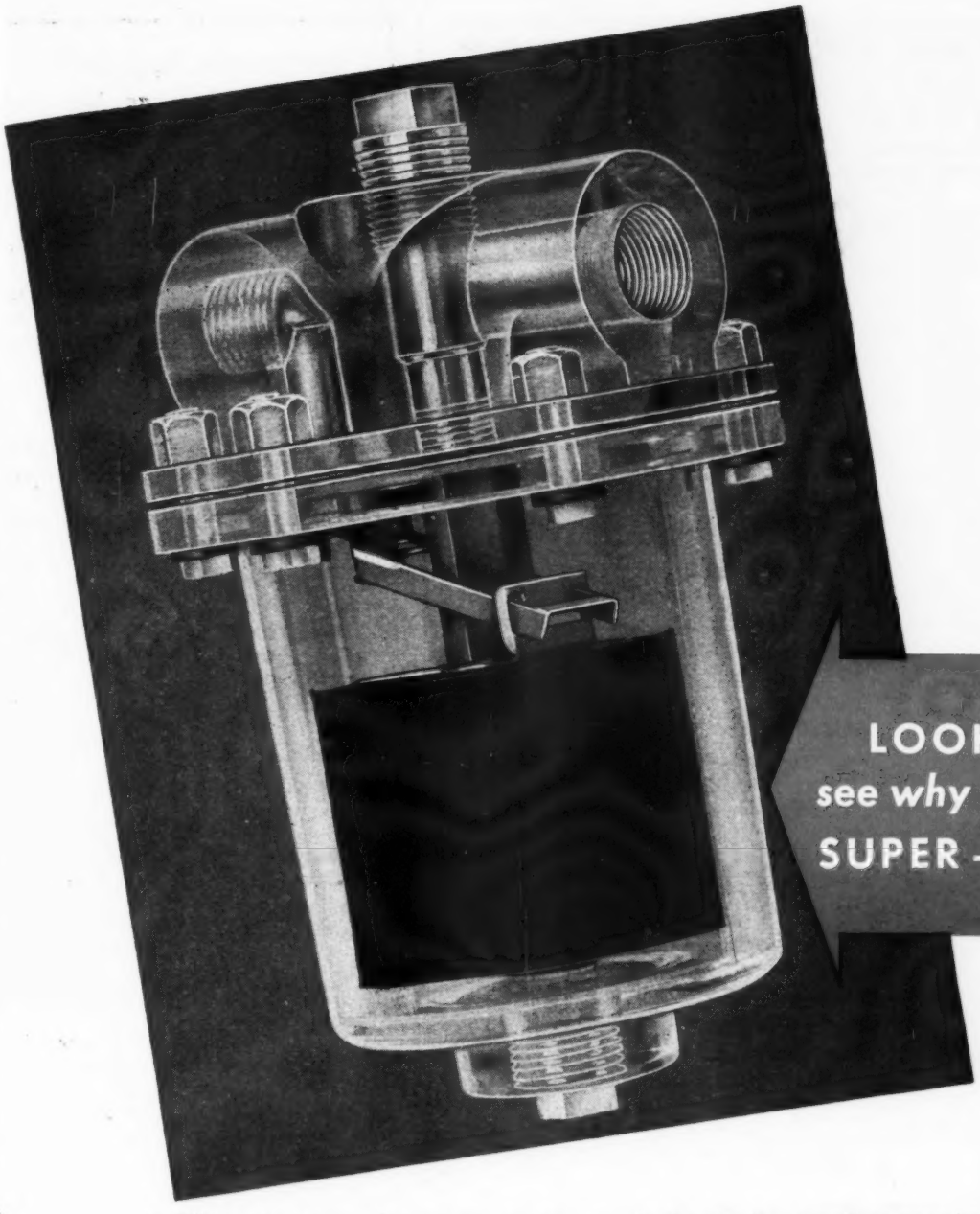
higher specific speeds (5700 and 9200) the power curves have their highest value at shutoff, which requires that motor size be determined by the highest head pumped.

Although the advantages of high specific speeds are obvious, the general trend toward them is slow, because ac 60-cycle motors are limited to 3500-rpm top speed for induction types and 3600 for synchronous. Consequently, for electrical power, top specific speed is also limited. For steam turbines, however, this limitation does not hold and pump designs have been improved, particularly in the low-specific-speed range. Speeds of 5000 to 6000 rpm are quite common for marine boiler-feed pumps. In Fig. 5, this would be the equivalent of going from impeller *A* to *B*, with a reduction in the necessary number of stages.

Improvements in suction designs have also helped to increase the usable specific speed. Biggest gain has been with vertical pumps where their suction is in a body of water for condenser cooling or water system. Here the suction-lift problem is solved by placing the pump directly in the water. In Fig. 5, this is the same as going from impeller *B* to one of those on the right.

Fig. 10 and 11 compare two pump sizes for condenser-circulating-water service. The pump in Fig. 10 is a double-suction slow-speed design, rated 50,000 gpm at 85% efficiency. The mixed-flow pump, Fig. 11, is rated 70,000 gpm at the same efficiency as Fig. 10. The pump in Fig. 11 is only that portion of the total assembly below the flange at the man's head. Upper portion is simply piping that would be required with the other pump also. Pump in Fig. 10 has a total specific speed of about 3250, or 2300 for each side of the impeller, whereas that of the pump in Fig. 11 is close to 7000. Even though the unit in Fig. 11 is only 60% as high and 15% as heavy, it has 40% more capacity than Fig. 10. Another advantage is that the mixed-flow pump is simpler and less liable to develop trouble.

Two Bonneville power lines in Washington are scheduled for completion in 1947, a 115,000-v transmission line from The Dalles, Ore., to Goldendale, Wash., and a 69,000-v line from Mossyrock to Morton, Wash. The Dalles line, which will be 24.1 mi and cost $430,000, will serve Klickitat County Public Utility District. It is to be started by May 1 and completed Sept 1. The 11.2 mi Mossyrock-Morton line, to give Lewis County P.U.D. a second point of delivery, is scheduled to go under construction Mar 1, with completion set for Oct 1.



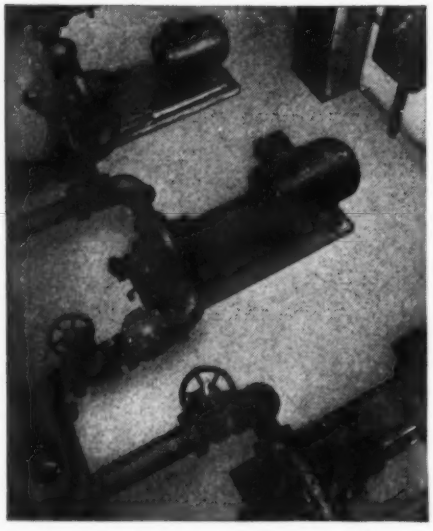
● This plastic model of an Anderson Super-Silvertop lets you see at a glance just why you save by using these up-to-date steam traps. Notice that all pipe connections are in the head of the trap with all passages drilled and bored smooth. This feature reduces the number of pipe fittings and installation time needed, yet does not resort to cored passages and split gaskets. With all connections in the head, inspection is easy—without disturbing pipe connections. Notice too, that an alternate top inlet connection provides for elbow connections. See how the bucket is guided on the center tube? True engineering accuracy is the result, as well as permitting the use of a longer lever arm with greater valve opening power. And a larger valve means more capacity for the same size trap.

These features in a steam trap give top efficiency and true economy. Let Super-Silvertops save money for you—in first cost, installation costs and operating costs. Send for full details, given in the helpful book —"How To Choose A Steam Trap"— sent free on request.

THE V. D. ANDERSON COMPANY
1934 West 96th Street Cleveland 2, Ohio

SUPER-SILVERTOP *steam traps*

PUMP NOTES by DEMING



"SPECIAL" PUMPING JOBS ARE OFTEN "STANDARD"

"SPECIAL" pumping jobs do not necessarily indicate the need for "special" pumps.

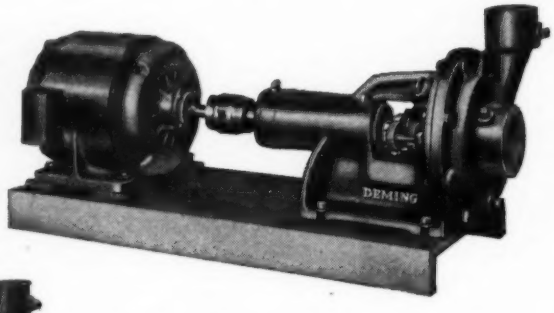
In numerous cases on record, Deming Pumps of standard design and construction are giving high standards of performance under conditions which the owners had good reason to think were "specialized" pumping jobs.

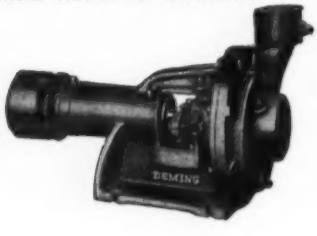
For example, the *standard* line of Deming Side Suction Centrifugal Pumps includes so many types and capacities that actual needs for a "special" pump are reduced to a minimum.

Two of many types of *standard* Deming Centrifugal Pumps are illustrated.

Illustration at right shows Deming Fig. 4003-M Side Suction Centrifugal Pump, direct connected to Electric Motor. Two ball bearing type with adjustable semi-enclosed impeller.

Illustrated below is the Deming Fig. 4003 equipped with a combination pulley suitable for either flat or "V" belt drive.





NEW BULLETIN NO. 3900-B

Write for a copy of this new, 8-page, 8½ x 11, illustrated bulletin which includes exterior and sectional views of single and two ball bearing types of Deming Centrifugal Pumps, ½", ¾", 1", 1½", and 2" side suction. Performance tables on Belt Driven and Motor Driven units are included in Bulletin No. 3900-B. Write for a copy.

DEMING DISTRIBUTORS LOCATED EVERYWHERE

Close cooperation between Deming field engineers and Deming Distributors makes a hard-to-beat combination of sales-engineering "know-how" to serve your pumping needs. If you don't know where to locate the nearest Deming Distributor, write us.

THE DEMING COMPANY • 202 BROADWAY, SALEM, OHIO

DEMING
INDUSTRIAL PUMPS

Engineer's Bookshelf

(*Continued from page* 128)

systems, and economics of electric service.

Although written primarily for a college text, the treatment is practical. Outside of 50 pages dealing with short-circuit-current and transmission-line calculations mathematics is practically non-existent in this book. Therefore it is well suited to every one wanting a broad, general knowledge of electric-power equipment.

Electrical Fundamentals

DIRECT AND ALTERNATING CURRENTS (1946) *3rd edition. By E A Loew, dean, College of Engineering, and professor of electrical engineering, University of Washington. 748 pp, 5½x8½ in., illust, cloth. $5. McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y.*

Written primarily for those desiring a short survey course in electric-circuit theory and electric-machine operating principles this book stresses fundamental principles rather than factual information. Emphasis is placed on the theory of electric circuits and the laws and principles necessary to understand electric-machinery performance.

This edition has been brought up to date, with new material added to strengthen subjects that needed to be covered more fully, and to replace old material that progress had made obsolete. Chapter III, which deals with circuit-problem solutions, has been expanded to include methods of simplifying circuits by delta-wye transformation and a generalized method of solving simple networks.

The discussion of revolving magnetic fields has been revised in the chapters on induction and synchronous machines. New material has been added on permanent-magnet materials, thermal and rectifier-type instruments, silicone resins and voltage regulators for synchronous generators and motors. All electrical workers confronted with electronic equipment will find the 55-page chapter on electron tubes and rectifiers a helpful contribution to the literature on this subject. Falling about half way between low-brow and high-brow treatment, this book is useful to practicing electrical engineers and to electrical workers who want a text one step above the highly practical.

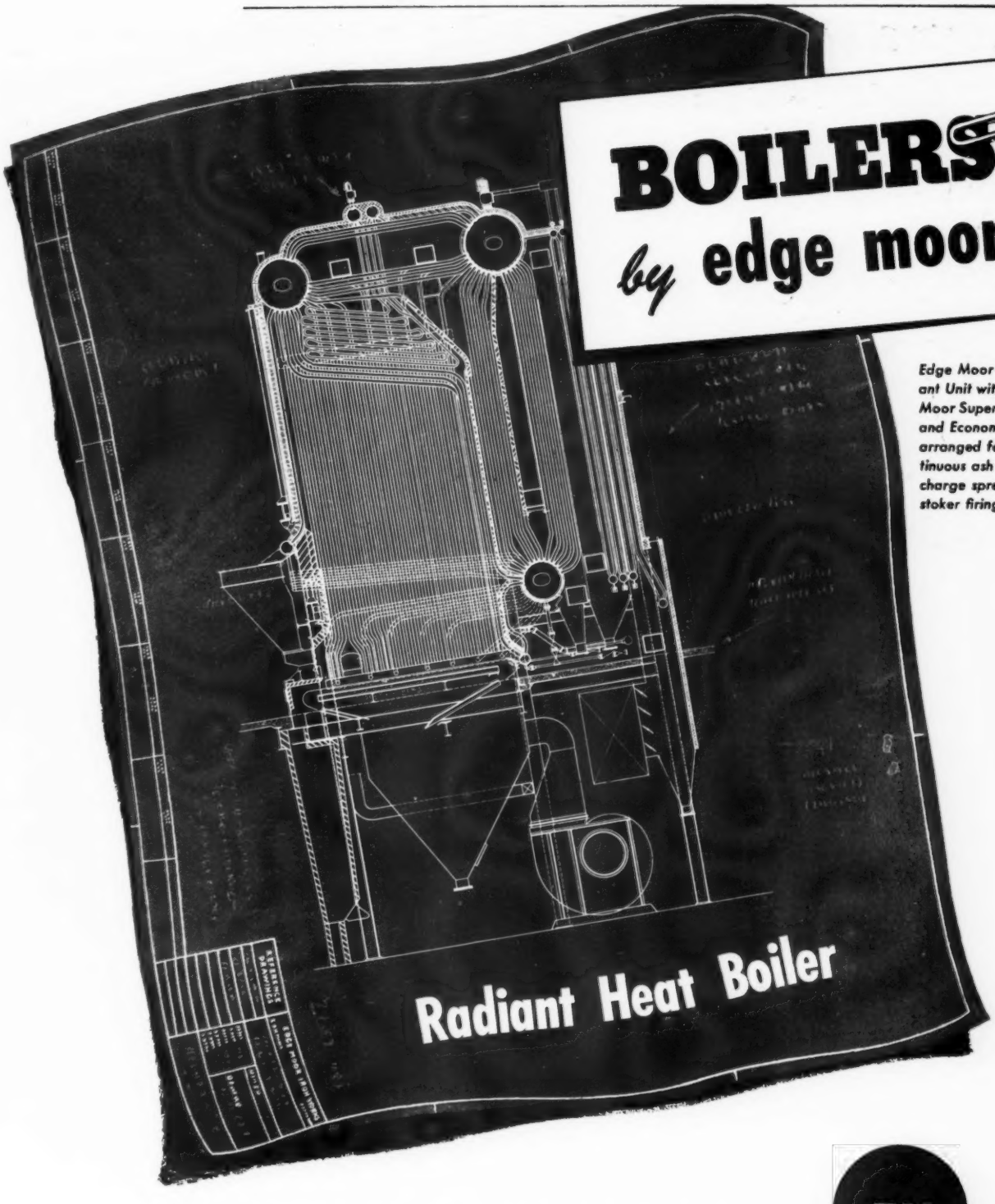
Diesel Pointers

DIESEL OPERATION AND MAINTENANCE. (1946) *By Orville L Adams. 366 pp, 6x9 in., illust, cloth, $5. Prentice-Hall, Inc, 70 Fifth Ave, New York, N. Y.*

Written for the diesel user as well as for the student in vocational and trade schools, this book begins with what might be called theory. But even in dealing with fundamental principles and design practices, the author emphasizes the operational and maintenance aspects, showing how certain practical problems have their origin in the engine's basic characteristics.

In presenting the operation and mainte-

BOILERS *by* edge moor



Edge Moor Radiant Unit with Edge Moor Superheater and Economizer arranged for continuous ash discharge spreader stoker firing.

Here is a unit designed to give the advantages of a 3-drum boiler, maximum boiler tube surface exposed to radiant heat and a water-cooled furnace—all in a minimum of space. Advantages include large water storage, generous steam liberation surface and quiet offtake drum. This quick-steaming unit delivers continuous high ratings over many years and is adaptable to all fuels.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today. EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

EM

edge moor

steam generating equipment

When something is needed "yesterday" Specify Air Express delivery

Here's the fastest solution to the problem of supplies and parts that are "fresh out"—get them by Air Express. This super-speedy service places even the most distant supplier only hours from your business.

Speeds up to five miles a minute now make coast-to-coast and overseas deliveries a routine affair for Air Express. And now it's a better value than ever before. The cost of shipping by speedy Air Express is *low*.

Specify Air Express-it's Good Business

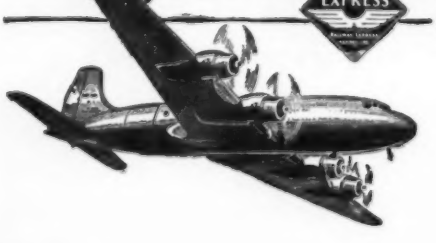
- Low rates. • Special pick-up and delivery at no extra cost.
- Direct by air to and from principal U. S. towns and cities.
- Air-rail to 23,000 off-airline communities.
- Direct air service to and from scores of foreign countries.

Just phone your local Air Express Division, Railway Express Agency, for fast shipping action . . . Write today for Air Express Rate Schedules containing helpful shipping aids. Address Air Express, 230 Park Avenue, New York 17. Or ask for them at any Airline or Railway Express Office. Air Express Division, Railway Express Agency, representing the Airlines of the United States.

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST



Rates are low

To Air Express a 10-lb. package **1549** miles costs only **$4.65!** Heavier weights are similarly inexpensive. Investigate!

nance data that are the heart of the book, the author deals first with the general philosophy of maintenance and inspection procedures. He then goes into detail about pistons, rings and liners, and about bearings. The book concludes with chapters on lubrication and fuel oil and its combustion.

While there may be some question about the success of the author's efforts to present a clear picture of diesel principles, in terms of operating and maintenance problems, the bulk of the book is full of practical information that should be of real assistance to both diesel users and students.

Steel Pipe

PIPE IN AMERICAN LIFE (1946) 48 *pp*, 8½x11 *in., illust, stiff paper. Single copy free. Committee of Steel Pipe Research, American Iron and Steel Institute,* 350-5th *Ave, New York* 1, *N. Y.*

Devoted to the use of steel pipe in homes, large buildings, process industries, railroads, shipping, mining, water-supply systems, oil industry, gas industry, refrigeration, irrigation and on farms, this booklet presents the historical background and modern use of metal pipe.

Elements of Metallurgy

METALLURGY. *By Carl G Johnson, asst prof of mechanical engrg, Worcester Polytechnic Institute. 3rd edition,* 418 *pp,* 5½x7½ *in., illust, cloth,* $4. *American Technical Society, Chicago, Ill.*

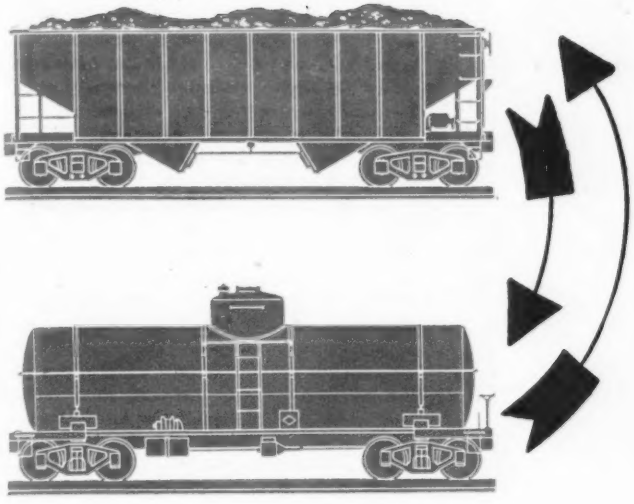
With much of the progress in the power field dependent on development of improved metals and alloys, especially in the high-temperature field, it is increasingly important for the power engineer to know at least the essential elements of metallurgy. Prof Johnson's book makes a good starting place in the search for such knowledge, because it is both comprehensive and easy to read.

The author begins by explaining the various properties of metals and how they are measured. He then lays a foundation for discussing the theory of alloys by explaining the differences between chemical and physical metallurgy. A chapter on the forming and shaping of metals is followed by discussions of special metals—bearing alloys, light metals and alloys, copper alloys. Most of the remainder of the book deals with the most important of metals—steel—with special attention to heat treatments, surface treatments and alloying. The book closes with chapters on cast iron, one of the oldest metals known to man, and powder metallurgy, one of the newest industrial arts.

Wagner Act and Industry

INDUSTRIAL PEACE AND THE WAGNER ACT (1947) *By Theodore R Iserman, member, New York bar.* 91*pp*, 5½x8 *in., paper.* $1.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

The foreword by Leo Wolman, professor of economics, Columbia University, pictures the scope of the author's undertaking and



changing fuels IN YOUR POWER PLANT?

It's No Problem to users of ENCO OIL BURNERS with COAL FIRED UNITS

Coal—oil—or both if necessary; changing fuels is no problem if your power plant is equipped with ENCO Oil Burners in combination with coal burning units. Your operations need only be governed by availability of fuels and comparative BTU costs.

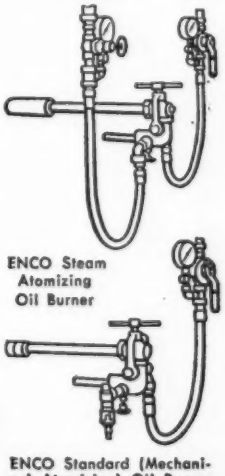
from coal to oil and back to coal if necessary!

ENCO Burners, designed for use with or without air registers and for natural or forced draft, are made in various sizes with capacities from 10 to 1,000 gallons per hour. Mechanical and steam atomizers may be used interchangeably to provide a wide load range from cold starting to full load operation.

With Pulverized Coal Burners either ENCO Mechanical or Steam Atomizers are used for ignition and entire load range. Bulletin OB-PC, giving complete details on use of ENCO Oil Burners with pulverized coal will be sent on request.

With Stoker or Hand-Fired Units, this same combination of oil burners with coal fired units can be used with either Steam or Mechanical Atomizer for partial or full loads. Complete information on either temporary or permanent installations of this type will be sent on request.

EC-468

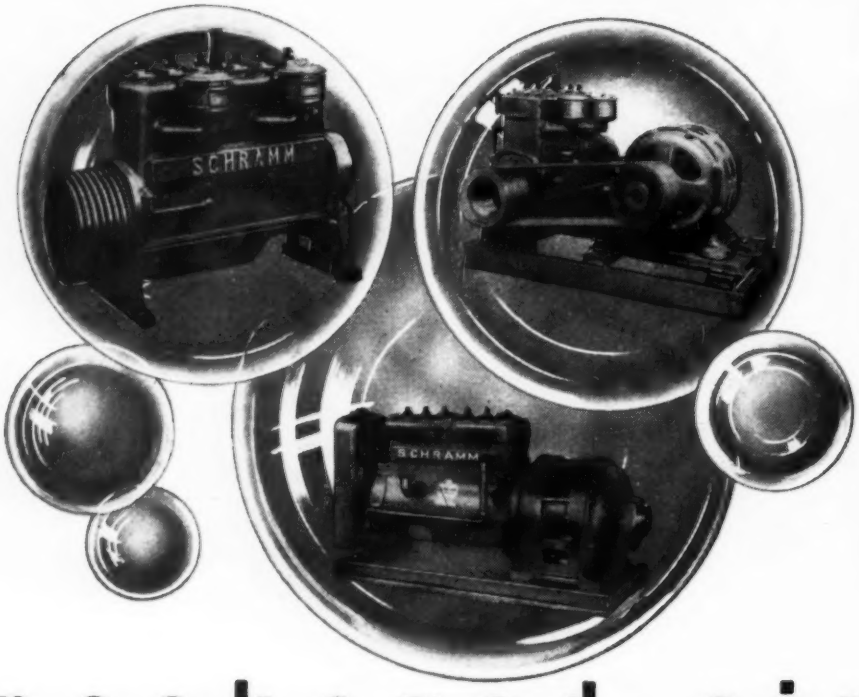


ENCO Steam Atomizing Oil Burner

ENCO Standard (Mechanical Atomizing) Oil Burner

THE ENGINEER COMPANY
Also Produces
Enco Streamline Baffles
Enco Oil and Gas Burning Equipment
Enco Fuel Oil Pumping and Heating Units
Enco Automatic Combustion Control

THE ENGINEER COMPANY
75 West Street, New York 6, N. Y.
Canadian Representative
F. J. Raskin Ltd., 370 Rachel E., Montreal, P. Q.



packaged air

is more than a pipe dream. SCHRAMM COMPRESSORS, for example, package air every day for industrial consumption. The selection of SCHRAMM AIR COMPRESSORS is influenced by features that include: (1) 100% water cooled; (2) forced feed lubrication; (3) mechanical intake valve; (4) compact, lightweight. Designed for heavy duty, continuous service and minimum attention. There's a SCHRAMM AIR COMPRESSOR for your every need, in sizes ranging from 2 to 600 cubic feet displacement.

SCHRAMM

INC.

THE COMPRESSOR PEOPLE

WEST CHESTER, PENNSYLVANIA

his exceptional qualifications for such a task.

Membership in labor unions between July 1935, when the Wagner Act was approved by the President, and the end of 1946 rose from 4 to 12 or 13 millions. Employes operated through some 200 national unions, and bargaining, by and large, became collective instead of individual.

From that start the experience of industry and the public with labor relations became an unhappy one. The author traces this development and discusses various questions arising from it. He begins with the avowed purpose of the Wagner Act—to increase output by lessening industrial strife. From this point follows a discussion of the failures of the act to promote output or peace, its tendency to increase unionism instead. Limitations of the act and questions arising from these limitations lead to a review of the National Labor Relations Board. Much of the difficulty from the Wagner Act, it is indicated, comes from the administration of the act by this Board.

The author devotes his closing two chapters to two important issues: (1) Did workers lose while unions gained under the act? (2) What should be done about the act?

Structural Engineering

MECHANICS OF MATERIALS (1947) *second edition. By P G Laurson, assoc professor of civil engineering, Yale School of Engineering, and W J Cox, Commissioner of Highways, State of Connecticut.* 422 *pp,* 6x8½, 480 *illust,* 16 *tables, cloth,* $4. *John Wiley & Sons, New York, N. Y.*

Eight years of class use led to an improved second edition of this textbook. Many parts were rewritten to gain greater clarity and a few topics have been added. The extreme conciseness which marks many textbooks has been avoided, effort has been made to give clear and ample explanations, illustrated by many solved problems.

In addition to the usual mathematical treatment utilized in this subject the concurrent physical behavior of the stressed bodies has been emphasized. Unusual attention has been given to outlining the principles that govern the determination of allowable stresses. Limitation of simplified mathematical expressions describing physical conditions are noted and discussed throughout.

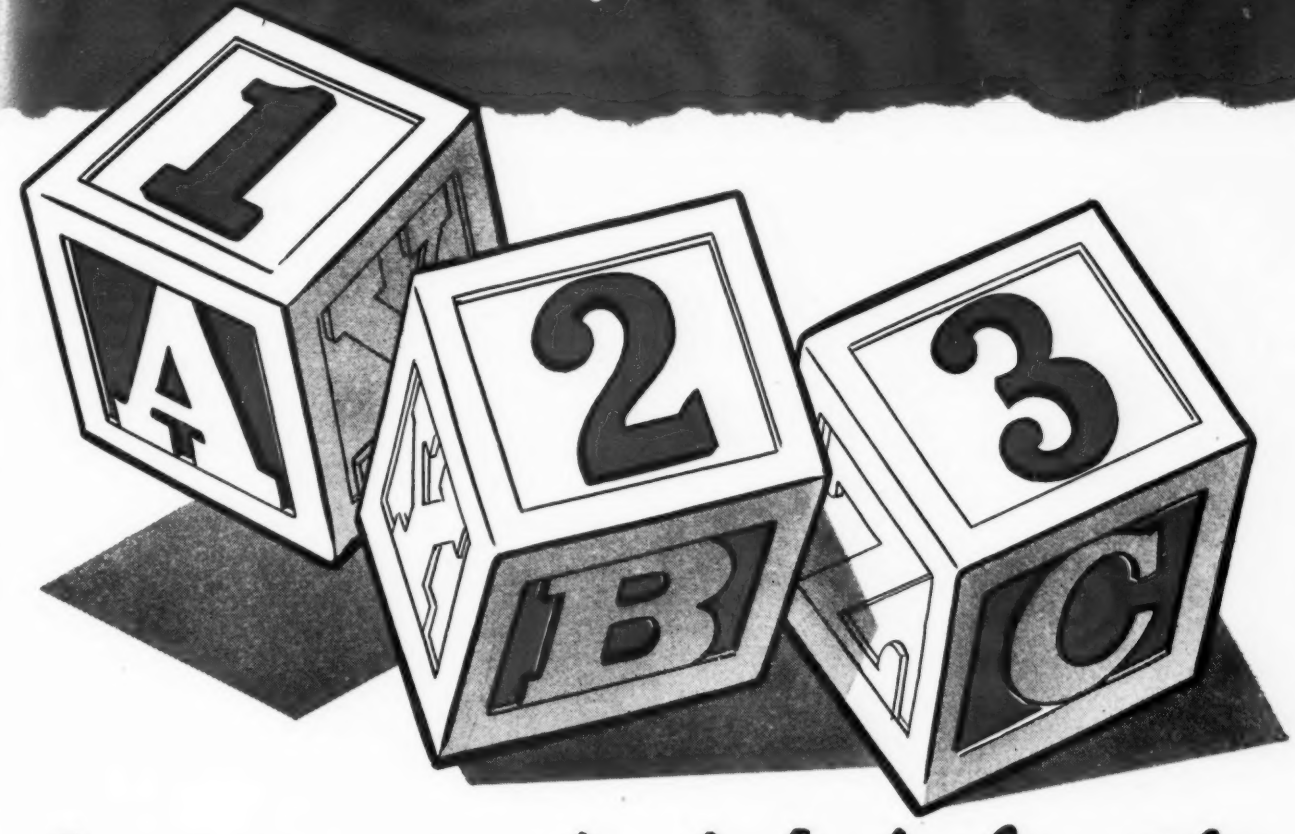
Trigonometry Review

TRIGONOMETRY REFRESHER FOR TECHNICAL MEN. *By A A Klaf, civil engineer, Board of Water Supply, City of New York.* 629 *pp,* 5½x9, *numerous examples with illust and problems,* $5. *McGraw-Hill Book Co, Inc,* 330 *West* 42*nd St, New York* 18, *N. Y.*

Written in three sections, this text uses the question-and-answer form, a precise and concise way of presenting a subject.

Section I deals with angles, their measurement and relationships. Fundamental trigonometric functions of an angle are presented in an easily remembered way based

It's as easy as...



to use coded lubrication

1 Why you need it. Standard's Coded Lubrication provides one of the simplest known methods for helping oilers determine what lubricant is needed at every lubricating point in your plant. It helps them avoid errors in filling oil cans, grease guns and other dispensing equipment. It eliminates the need for their learning a great number of detailed instructions and grade numbers of lubricants.

2 How it works. All lubricants used in the plant are assigned numbers. A number is applied to each storage container or dispensing unit indicating the lubricant it contains. Each spot to be lubricated is also marked by an easily applied decal numbered to indicate the lubricant required.

3 What it does! The results you get with Coded Lubrication make it well worth while. It reduces breakdowns resulting from the application of wrong lubricants. It prevents application of costly lubricants where ordinary lubricants can be used. It simplifies training of oilers.

A Standard Oil Lubrication Engineer will fully explain Coded Lubrication and its application to your plant. Write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Where open gears need water-resistant lubrication use . . .

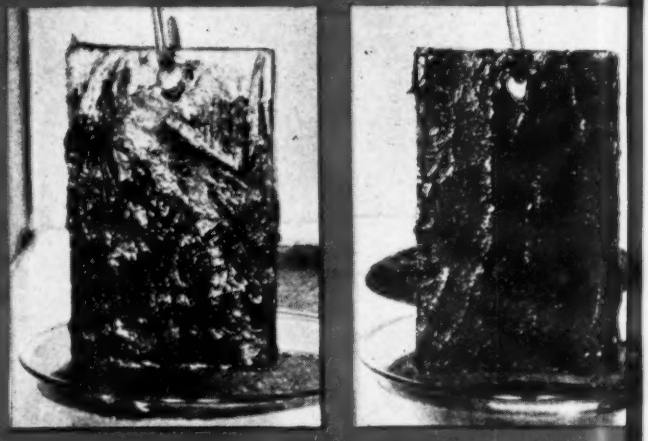
CALUMET Viscous Lubricants

THE SIMPLE TEST described here shows how Calumet Viscous Lubricants reduce lubricant consumption and protect open gears against wear, even though subjected to the direct washing action of water.

Calumet Viscous Lubricants give these advantages because they are compounded from selected soaps and oils of proper viscosities and contain a special additive which makes them adhere closely to metal. They do not require heating before application, and all but the heaviest grades can be sprayed. These application features offer direct savings in time and grease.

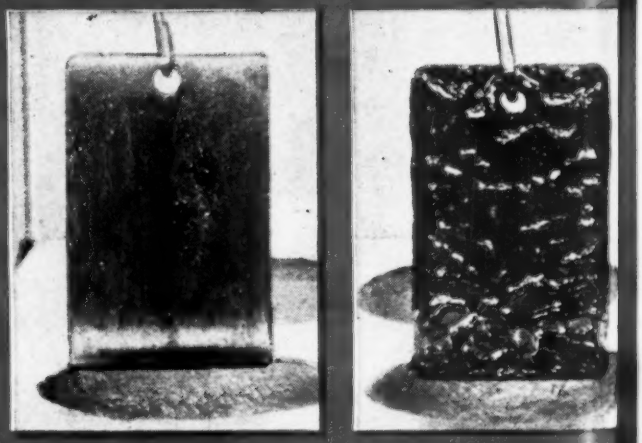
A Standard Oil Lubrication Engineer will help you select the grade you need for low cost open gear lubrication.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.



Test equipment for comparing water resistance of greases. Me strips are coated with greases to be compared. Left strip conventional type soda soap grease. Right strip – a Calu Viscous Lubricant.

The instrument dips the strips into beakers containing wa at 80° F. at the rate of 30 times per minute for 20 hours.



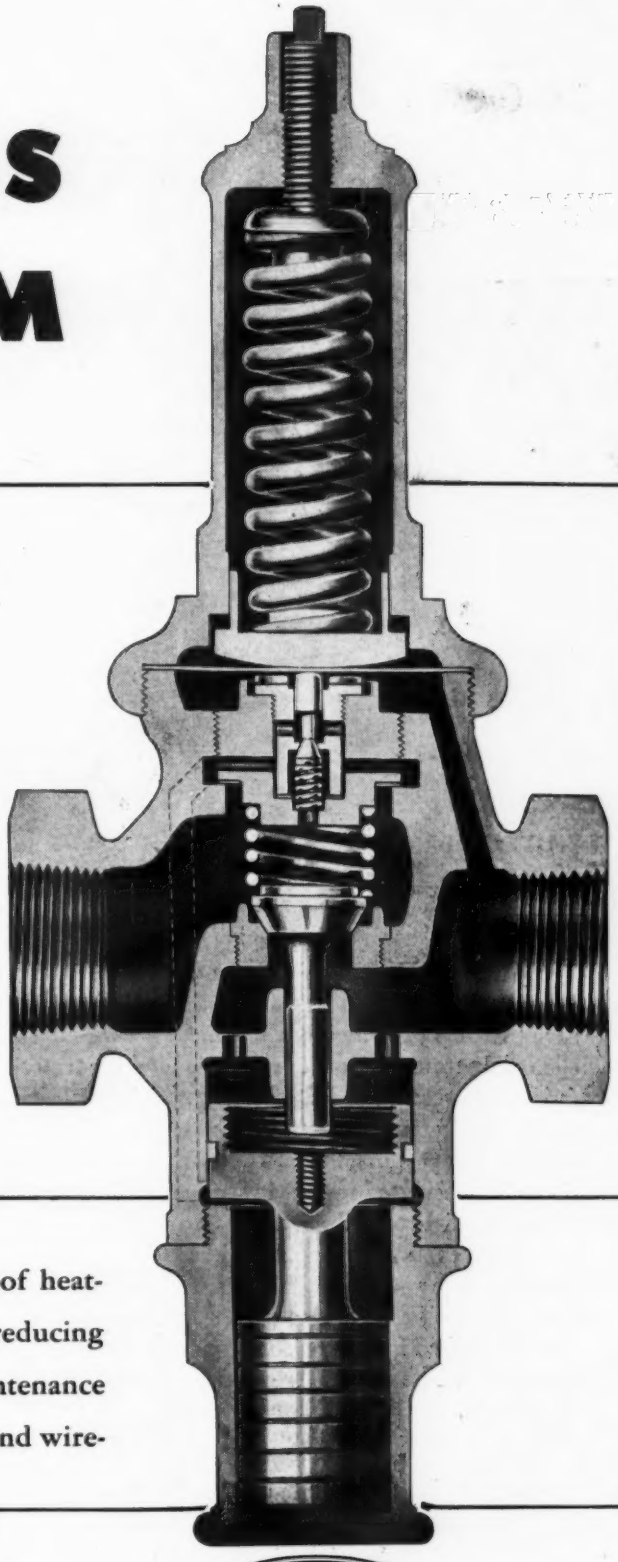
The same test strips after the 20-hour test. The strip contain conventional type soda soap grease is practically bare. The s holding Calumet Viscous Lubricant is still completely cove

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

STAINLESS STEEL TRIM

Reduces Maintenance . . .
Assures Longer Operating
Life of . . .

MASONEILAN
No. 11
Reducing Valves



Because the pilot, valve and seats are made of heat-treated stainless steel, Masoneilan No. 11 reducing valves give accurate long life and reduce maintenance by minimizing valve sticking, steam-cutting and wire-drawing. And remember this stainless steel trim is standard . . . costs you no more. Investigate and install Masoneilan No. 11. These regulators will save you money by staying in service longer. Write for catalog, today.

MASONEILAN

MASON-NEILAN REGULATOR CO.

1186 Adams St., Boston 24, Mass., U. S. A.

New York • Philadelphia • Buffalo • Pittsburgh • Tulsa • Cleveland • Chicago
Atlanta • St. Louis • San Francisco • Los Angeles • Houston
Mason Regulator Co. of Canada, Ltd., Montreal and Toronto

IT GOES ON *TO STAY!*

AND *INSULATES* UP TO 1800° F.

SIMPLY add water, mix and you're ready to do a fast-covering, efficient job with Baldwin Hill No. 1 *Insulating* Cement. To save time for your maintenance men, it sticks *instantly*—does not slide off bottom-surfaces or roll up behind the trowel. To save btu's *for you*, it's compounded of finely nodulated *black* Rockwool—a 3-inch application, for example, reduces 800°F surface temperature to 158°F. Important, too, B-H No. 1 takes expansion and contraction of the insulated surface in stride—without peeling or cracking. And, a special rust inhibitor prevents corrosion, insures a permanent bond even when applied while the surface is hot.

It will pay you to put B-H No. 1 Cement to work on valves, fittings and other irregular surfaces where heat loss is costing you money. Packed in convenient 50-pound multi-wall bags ready for instant use. The coupon brings descriptive literature and a working sample.

Baldwin-Hill

Specialist in Thermal Insulation

SEND ME a sample of B-H No. 1 Insulating Cement and the B-H data book "Industrial Insulation".

Baldwin-Hill Co., 514 Breunig Ave., Trenton 2, N. J.

NAME.....POSITION.....

FIRM.....

ADDRESS.....

CITY.....ZONE....STATE.....

on a "shadow-and-perpendicular" concept. Methods of periodic functions, identities, inverse functions and trigonometric equations are explained in detail. Logarithms are covered and also the importance of significant figures and accuracy of computations. Theory and use of the slide rule are also included.

Section II consists of application of plane trigonometry. Some important problems covered are small angles, periodic functions, vectors and vector quantities, surveying, aerial and sea navigation, belts, helices, light and hydraulics. One full chapter is devoted to polar coordinates, complex numbers, De Moivre's theory and trigonometric series.

Section III gives an extensive treatment of spherical trigonometry. There is also a chapter devoted to spherical triangles. The final chapter stresses the application of spherical trigonometry in the solution of terrestrial and astronomical triangles.

BOOKLETS

ACRMA EQUIPMENT STANDARDS (1946 *Edition*) *Over* 100 *pp, 26 illustrations,* 16 *pp of tabular material, spiral wire binding,* $2, *postpaid.* Copies of individual parts of the complete Standards publication may be purchased separately at varying prices. Air Conditioning and Refrigerating Machinery Association, 717 Southern Bldg, Washington 5, D. C. The 1946 edition reflects many of the advances in arts of refrigeration and air conditioning in the seven years since publication of preceding edition. Individual parts of complete standards are: Part I—Room Air Conditioners and Self-Contained Air Conditioners. Part II—Compressors and Condensing Units. Part III—Condensers and Receivers. Part IV—Water and Brine Coolers. Part V—Miscellaneous Standards.

AIR CONDITIONING AND REFRIGERATION BUSINESS *By V C Kyleberg, William L Beck and Howard E Way, under supervision of machinery and metals section, industry div, Office of Domestic Commerce. Send* 20¢ *for copy to Superintendent of Documents, Washington* 25, *D. C.* Booklet explains nature of refrigeration and air-conditioning business, sets forth some opportunities in the field and explains skills needed for successful operation of a small business within the industry.

Bureau of Reclamation plans addition of a third 15,000-kw power-generation unit to Palisade Dam on Snake River in southern Idaho. Two 15,000-kw units already have been authorized for the project, which is still in preconstruction stage.

Construction of a new pilot plant is under way at Monsanto Chemical Co's plastics div, Springfield, Mass. The new building, to cost an estimated $175,000, will be completed by early summer. Pilot plant, designed for experimenting with production methods for new products, will be a 3-story brick, steel and concrete building with 60x120-ft floor size. It will be built by Adams and Ruxton Construction Co of Springfield.

Pumps with a **DIFFERENCE**

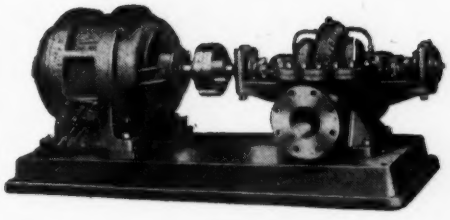
that means savings for **YOU**

It's no trick to design a centrifugal pump that will give *passable* service. But to give such pumps the extra measure of efficiency that saves you the most money requires skilled engineering—rigidly controlled foundry practices—plus long experience. Gardner-Denver centrifugals do a better job because they are hydraulically and mechanically *right* —because their water passages are properly proportioned—because castings are absolutely smooth. For complete information about any of the pumps shown on this page, write Gardner-Denver Company, Quincy, Illinois.

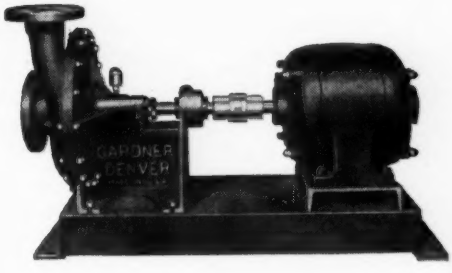
GARDNER-DENVER

SINCE 1859

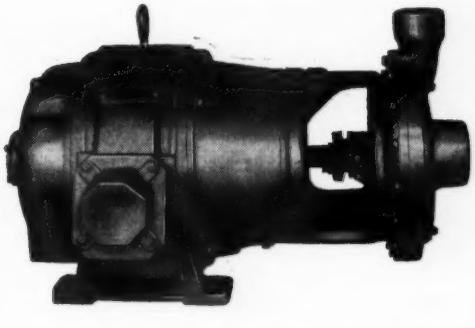
ENGINEERING QUALITY SINCE 1859



Easy accessibility *is a feature of Gardner-Denver Double-Suction, Single-Stage Centrifugal Pumps. Available in sizes to cover all heads up to 300 feet. In the first year of operation, these pumps often save enough in power costs to pay for themselves and their motors.*



Low in first cost—*easy to install; Gardner-Denver Side-Suction Pumps are ideal for replacement of outmoded units in general service. Capacities up to 2.3 million gallons per day or 1600 gallons per minute can be handled at heads up to 100 feet.*



Upside down—*or right side up—these Gardner-Denver Close-Coupled Centrifugals operate efficiently—take little space—because pump and motor are combined. Gardner-Denver Close-Coupled Centrifugals are designed for capacities up to 250 gallons per minute and heads up to 250 feet.*

A Tread That Stops Slip!

Inland 4-Way Floor Plate

Yes, there is a tough, rugged flooring that will reduce slipping and falling hazards in your plant and on your equipment. Inland 4-Way is the safety flooring with raised projections designed and spaced to give a positive grip to foot or wheel in all directions.

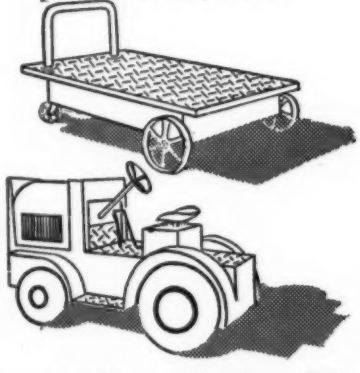
The 4-Way pattern drains freely, sweeps and mops easily, requires a minimum amount of maintenance and lasts for years and years.

Because it is steel, the strongest flooring you can use, Inland Floor Plate will not warp, splinter, crack, burn, or absorb liquids and odors. It's easy to use for floors, steps, platforms, ramps and catwalks within your plant or on mobile and stationary equipment you manufacture or use.

Available from leading steel distributors. Write for catalog.

FOR PLANT INSTALLATIONS

FOR YOUR PRODUCTS, TOO



OTHER PRODUCTS: BARS • STRUCTURALS • PLATES • SHEETS • STRIP
TIN PLATE • PILING • REINFORCING BARS • RAILS • TRACK ACCESSORIES

INLAND STEEL CO.

38 S. Dearborn Street, Chicago 3, Illinois

Sales Offices: Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul

Pump Q and A

(*Continued from page* 120)

Q 12—What size cushion chamber is required for a triplex power pump?

A—Triplex pumps, both single- and double-acting, have three cycles per revolution, and flow to and from the cushion chamber during each cycle is slightly over 1% of the pump's displacement per revolution. For slow-speed pumps this makes it possible to use a relatively small cushion chamber, but since modern triplex pumps operate at higher speeds, the frequency with which a small quantity of fluid must enter and leave the chamber requires consideration. For pump speeds in excess of 100 rpm, make the air volume 100 to 150 times the flow variation, or 1 to 1.5 times the pump displacement per revolution, thus making the change in air pressure negligible. Then, instead of necking down the lower end of the chamber and using a reduced-size connection to the pump, as is customary for direct-acting and other low-speed pumps, use as short and as large a connection to the pump's valve chest as is practicable.

Q 13—What size cushion chamber does a quintuplex power pump require?

A—On both single- and double-acting pumps of this type, the actual volume flowing to and from a cushion chamber each cycle is too small to use as a basis of calculating chamber size. If the chamber is large enough to hold its charge a reasonable length of time, air-pressure variation will be negligible. On the other hand, the higher speed of quintuplex pumps and the five cycles per revolution make a short maximum-diameter connection to the valve chest, mentioned in Q 12, doubly important.

Q 14—How much difference does a short, full-sized connection to a cushion chamber make on a moderate-speed power pump?

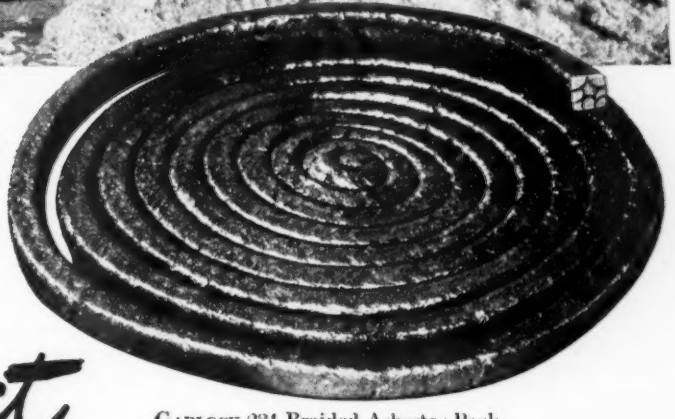
A—Fig. 6 and 7 show suction cushion chambers as arranged by different designers for the same triplex boiler feed-pump installation. Fig. 6 provides a cushion volume of about 2.5 times pump displacement per revolution, directly connected to the pump suction chest by a long-radius 5-in. elbow and about 9 in. of 5-in. pipe. In Fig. 7 cushion-chamber volume is 1.5 times pump displacement, and is connected to the 4-in. suction line about 1 ft. from the suction chest by 2 ft of 2-in. pipe and 1 ft of 4-in. pipe. Both chambers are large

FROM

RAW MATERIAL

TO

Finished Product



GARLOCK 234 Braided Asbestos Packing in Coil form. GARLOCK 244—Coil with wire. GARLOCK 239—Rings. GARLOCK 249—Rings with wire.

60th Anniversary 1887—1947

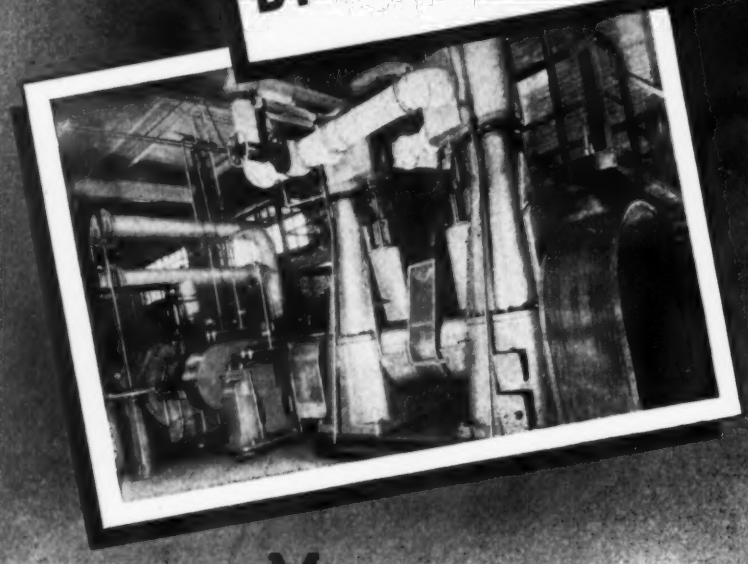
ALL GARLOCK packings are *quality controlled* from raw material to the finished product. Photo shows the first step in the preparation of crushed asbestos fibre for use in the manufacture of Garlock asbestos packings. One of these Garlock products is GARLOCK 234 which is recommended for rotary or centrifugal pumps handling hot water, cold water, caustic solutions or weak acids. For long, dependable service specify GARLOCK 234.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada, Ltd., Montreal, Que.

GARLOCK 234

TROY-ENGBERG
STEAM ENGINE

SAVE
BY USING
BY-PRODUCT POWER



Make your STEAM do two big jobs . . . eventually one of them at little or no cost. With proper heat balance your steam can provide—FIRST, power for driving equipment, and SECOND, heat units needed for processing or heating.

Use boiler steam to run a Troy-Engberg Steam Engine. THEN use the exhaust in your heating or processing lines. Drive your pumps, stokers, generators, blowers or compressors with By-Product Power. Use a Troy-Engberg Steam Engine as a reducing valve and your power cost saving will pay for the engine in a very short time.

Send for Bulletin 306

TROY ENGINE & MACHINE COMPANY
Established 1870
2525 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES · GENERATING SETS · GENERATORS

enough to absorb the flow variation with very little pressure change in the cushion space. But the connection and mounting, Fig. 6, reduces pressure fluctuation in the pump chest to about 1.5 ft of water, while Fig. 7 will reduce pressure fluctuation to only 12 to 15 ft of water. This shows that a well-designed installation may be ten times as effective as a poor one.

Q 15—Because an air chamber seriously contaminates deaerated feedwater how can the suction of a boiler-feed pump be cushioned?

A—Fig. 8 shows the Worthington steam-jacketed suction cushion chamber for reciprocating boiler feed pumps. Cushion space *A* contains steam at suction pressure produced by evaporating a little of the feedwater in the chamber. There is no connection between cushion space *A* and the steam jacket. The latter is supplied with saturated steam through connection *C* at a pressure from 10 to 100 or 150 psi greater than pump suction pressure. As jacket steam condenses it drains through the strainer and trap.

When jacket steam is first turned on, heat transfer through the chamber wall to the feedwater is rapid and enough feedwater evaporates to force the water level down to *E* quickly. Stabilization of water level at this point is positive since heat transfer from the cushion steam to the water, a few inches below the steam jacket, is equal only to heat loss from the chamber. Insulate the chamber to prevent unnecessary heat loss. A vent may be provided at *F* to bleed off air before putting the system in operation.

Q 16—What are the advantages of a steam-jacketed cushion chamber?

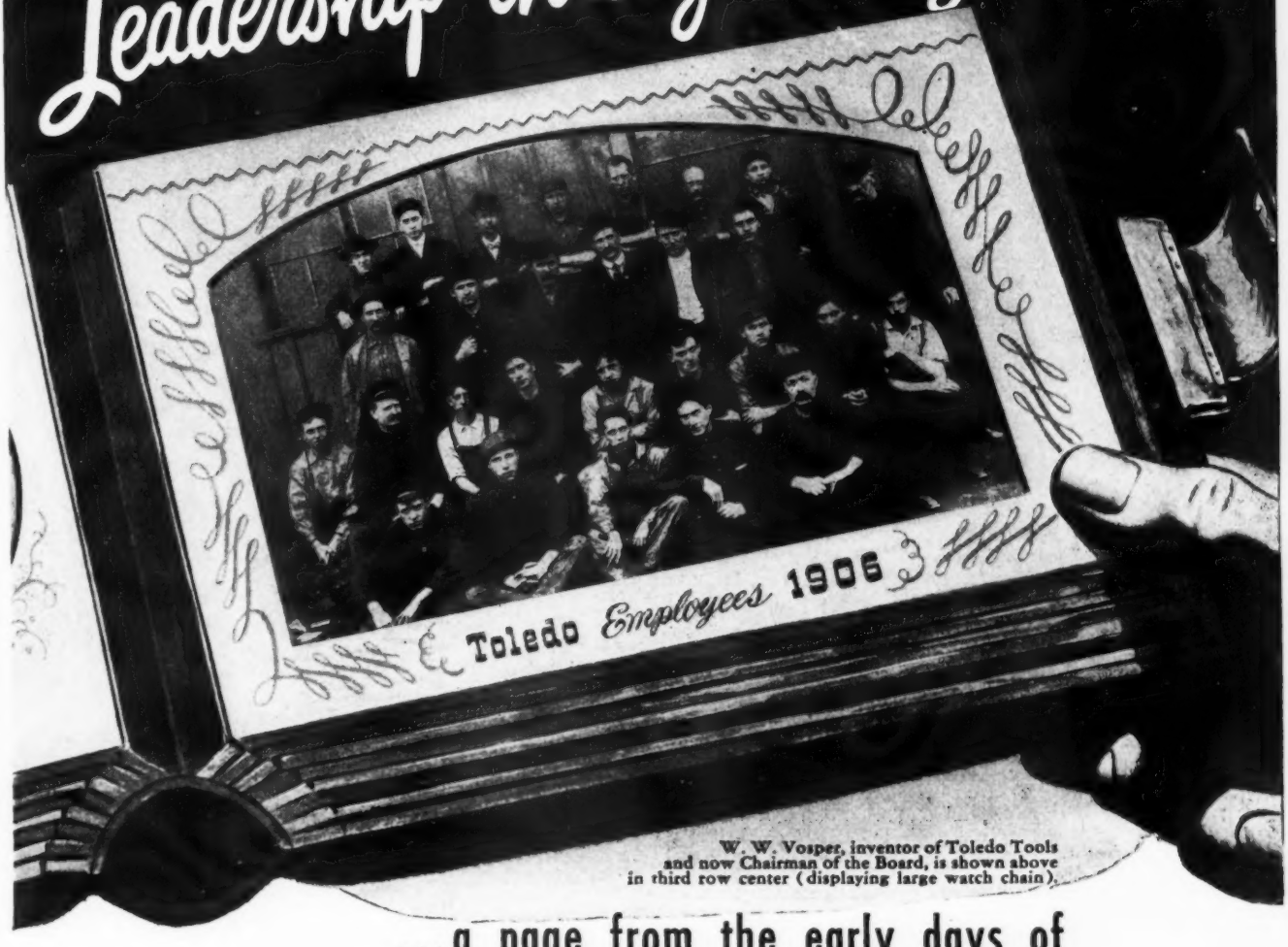
A—1. Pumped fluid is not contaminated.

2. The chamber requires no attention or recharging. Water level remains practically constant over a wide pressure range in cushion space and steam jacket as long as jacket pressure is higher than pump suction pressure.

3. Very little heating steam is required. A chamber like Fig. 8 with a cushion space of 2 to 3 gal uses only 3 to 4 lb of steam per hour. Only problem is to find a steam trap that consistently handles this small quantity of condensate without blowing steam.

4. Liquid level may be placed close to the pump suction for most effective cushioning, since it changes little during a gradual pressure change. Even with a sharp reduction in suction pressure, the amount of steam that may expand into the suction chest will con-

Leadership through 44 years...



W. W. Vosper, inventor of Toledo Tools and now Chairman of the Board, is shown above in third row center (displaying large watch chain).

...a page from the early days of TOLEDO PIPE TOOLS!

Experience means a lot in building any product. In the field of pipe fitting—there's a wealth of engineering and manufacturing know-how behind all pipe tools and power pipe machines bearing the famous TOLEDO trademark!

Toledo experience goes back 44 years... to the days of the Iroquois Theatre fire... the Wright Brothers' first airplane flight... and the start of the Panama Canal. Through the years—Toledo has jealously guarded its reputation for producing top-quality tools... of high accuracy and dependability... available to you at low prices.

The long-term service record of our employees is also important to you—assuring better products and better service. The *average term* of employment is—Factory employees... 12 years • Working supervisors... 23 years • Foremen... 27 years • Salesmen... 12 years • Officers and Dept. Managers... 29 years.

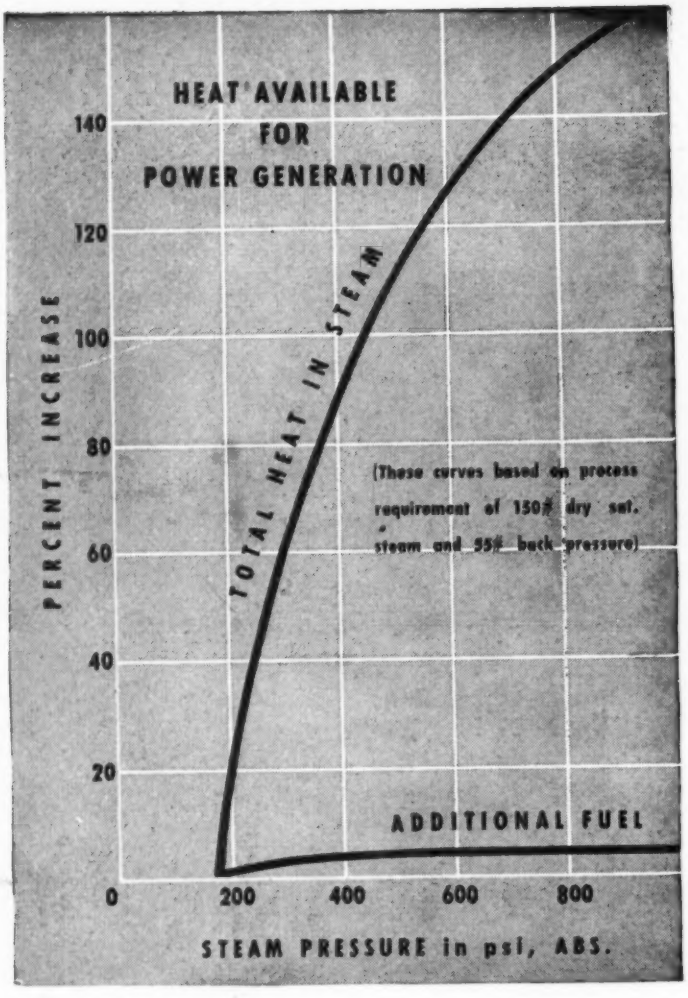
Toledo is proud of this record of service and it assures the hundreds of thousands of Toledo users that Toledo Tools and Power Pipe Machines are of the highest standard of quality and efficiency. When you tool up with Toledo you are tooled up *right!* Our distributors—your dealer—will serve you. The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.

Toledo No. 1 Plain 1" to 2" Threader pioneered the Toledo line and is still preferred by many users today.

"TOLEDO" TRADE-MARK REGISTERED

TOLEDO

PRECISION PIPE TOOLS



Here's "By-Product Power" ...AT LOW COST

Many plants are producing low-cost power from process steam *before* delivering it to process equipment. Here's one way it's done! Steam, at full boiler pressure, is delivered to extraction or back-pressure turbines and power is generated — at little more than the cost of operation and maintenance of generating equipment. The bled steam can then be piped direct to meet process needs.

A Kuljian Survey will determine quickly the extent to which such opportunity exists in your operations. Kuljian Engineers have specialized for years in power plant design and construction. It may pay your company large dividends to take advantage of this service. Your inquiry is invited, now.

THE KULJIAN CORPORATION

Engineers • Constructors

1518 Walnut Street • Philadelphia 2, Pa.

New York 6 Washington 5

dense in the suction stream without disturbing pump operation.

Q 17—Is a steam-jacketed cushion chamber practical for the discharge side of a boiler feed pump?

A—No, since boiler feed-pump discharge pressure is necessarily higher than the pressure of any available saturated steam. It is possible to obtain the higher temperature required by using superheated steam, but the advantages of self-regulation and automatic operation are lost. Also, the higher temperature and poor heat transfer, from dry superheated steam to the outside surface of the cushion chamber, make it relatively difficult to design a chamber that works even with careful and more or less continuous hand regulation.

Diesel Engines

(*Continued from page* 94)

either remains liquid or cracks, depending on surface temperature and duration of contact.

The foregoing conclusions result from reasoning; now we can look at some experimental evidence supporting them:

Effect of Load. A normal engine burning normal fuel should show practically smoke-free exhaust between ¼ and ¾ load. Approaching and exceeding full load, smoke density should increase rapidly, partly because fuel-air mixture becomes richer, and in spots overrich, and partly because injection duration is longer and part of fuel ignites late. At light load, near the misfiring point, cold smoke should appear because part of fuel fails to ignite, and part ignites so late that it has no opportunity to complete its combustion. Curve 1 of Fig. 3 shows effect of load on an average engine with normal fuel.

Some engines may not follow this pattern. If combustion chamber is very hot (for instance, because of an uncooled insert) all fuel ignites promptly even at idling load and the low-load hook of the smoke curve is missing, curve 2, Fig. 2. On the other hand, if combustion chamber is fairly cold and in addition the spray deteriorates at low fuel-rack setting, low-load smoke is accentuated and may even exceed the heavy-load smoke, as in curve 3, Fig. 2.

Injection Timing. Advancing injection should benefit smoke for two reasons: (1) Fuel has more time to burn. (2) Early injection causes explosive combustion, which favors indiscriminate

The alert technician in the illustration is censoring film—the strength of film in Sinclair industrial lubricants designed for protection of your valuable machinery.

These tests prove that Sinclair lubricants have the film strength to keep moving metal parts separated under extreme temperature and pressure conditions. With the SAE film strength test machine, skilled laboratory technicians check constantly, reject substandard product, assure you of essential protection.

Every batch of lubricant in process gets an equally careful check for other all-important qualities. Constant research by Sinclair assures you of the benefits of new developments in film strength...and in all other prime lubricant qualities.

Sinclair Lubricants for the Power Plant

For Turbines:
SINTURLITE OILS
For Steam Cylinders:
SINCLAIR STEAM CYLINDER AND VALVE OILS
For Compressors:
RUBILENE OILS
For General Lubrication:
COMMANDER OILS
For Ball and Roller Bearings:
BEARING GREASE AF

SINCLAIR REFINING COMPANY • 630 FIFTH AVENUE, NEW YORK 20, N. Y.

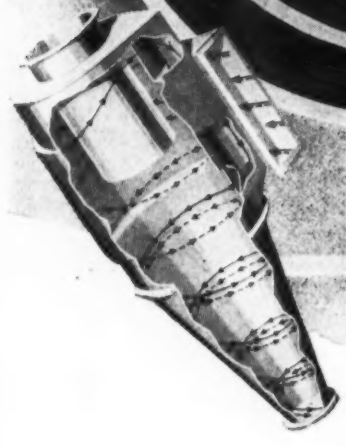
SINCLAIR

Lubricants for Industry

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE

high efficiency

DUST COLLECTION



Only Buell Dust Recovery equipment affords these six extra-efficiency features: 1—The "Shave-Off"; 2—Large Diameters; 3—Extra-Sturdy Construction; 4—Correct Hopper Design; 5—Split-Duct Manifolding; 6—Inner Welds Ground Smooth.

Write for Buell's book—"The van Tongeren System of Industrial Dust Recovery".

BUELL ENGINEERING CO., INC.
Suite 5001—70 Pine Street, New York 5, New York

buell

van Tongeren DUST RECOVERY SYSTEMS
DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

turbulence. But if injection is advanced too far we encounter cold smoke due to spray impingement, and finally misfire. Fig. 3 and visual observation of smoke color bear out these conclusions.

Compression Ratio. High-compression ratio is conducive to hot smoke and low-compression ratio to cold smoke. Ordinarily, medium-compression ratio is best. Cold smoke can be corrected, however, by high-compression ratio when caused by low load or other factors discussed below, and hot smoke due to heavy load can be mitigated by low-compression ratio. These conclusions are borne out by Fig. 4 and Fig. 5, which is a crossplot of Fig. 4.

Fuel Dispersion. Poor mixing, whether it is caused by poor atomization, poor spray distribution, or insufficient turbulence, always increases smoke, especially heavy smoke. Testing an engine under identical conditions, except nozzle condition, shows that smoke density increases at all loads if the nozzle is dirty.

Fuel Volatility. Increasing fuel volatility, as it helps mixing of fuel and air, produces results similar to improving dispersion, and should help smoke under all conditions. There are only two possible exceptions and both are extreme cases. One is where mixing is already perfect and better fuel volatility no longer improves it, and the other is complete misfire.

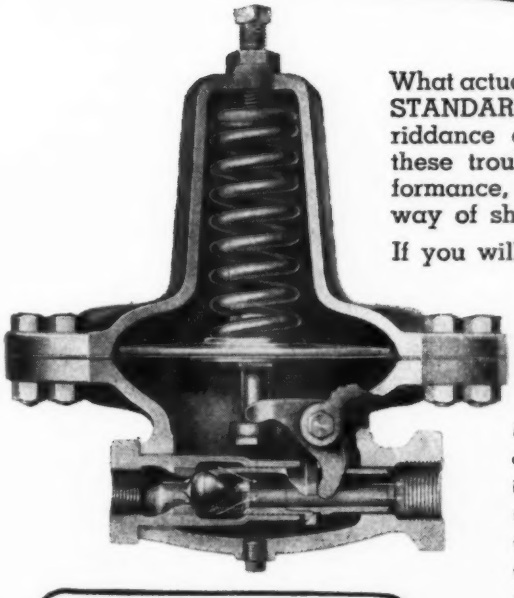
Because fuel volatility works through better mixing, average fuel volatility or midboiling point influences smoke most. Experimental observations bear this out, showing the 50% point to be a more dependable index of smoke tendency than the 90% point.

Cetane Number. An increase in fuel cetane number should improve cold smoke and aggravate hot smoke, with over-all effect depending on actual conditions. If cold smoke predominates, as it would if low-compression ratio, low cetane number, light load or a combination of these factors prevailed, an increase in fuel-ignition quality decreases the smoke. If hot smoke predominates, an increase in cetane number will increase smoke. Under normal conditions, between 40 and 60 cetane number, exhaust smoke is fairly independent of fuel-ignition quality. Observations of Wetmiller and Endsley bear out these conclusions.

Smoke Diagnosis. We may be confronted with smoke either from a service engine or from an engine under development. In a service engine, we try to eliminate smoking by correcting possible maladjustments. The most frequent offenders are overload, late in-

GET THESE COST MAKERS *off your Hands!*

DO IT WITH THE CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000



What actually happens when you install the CASH STANDARD Type 1000 is a quick and permanent riddance of the cost makers pictured above. If these troubles are yours, concerning valve performance, why not take this simple and proved way of shaking them off your hands.

If you will send for Bulletin 962 you will get the big, important picture of how the CASH STANDARD Streamlined type 1000 Pressure Reducing Valve works to your advantage continuously, giving you the benefits listed below.

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.

CASH STANDARD CONTROLS... VALVES

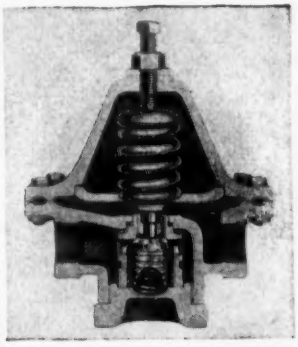
A. W. CASH COMPANY
DECATUR, ILLINOIS

•

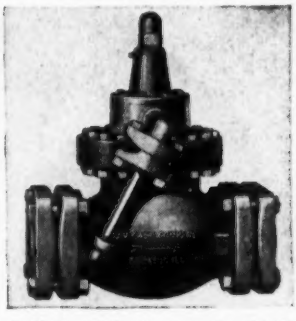
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

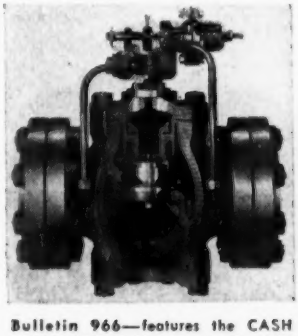
•



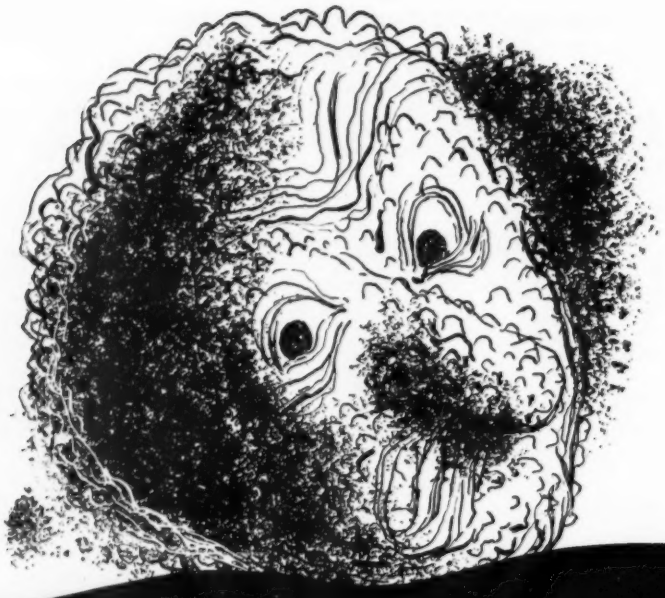
Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.



Tie the Can to Corrosion!

by using De-ionized Water for your boiler feed

ILLCO-WAY Alkalinity is readily and accurately controlled when you use ILLCO-WAY De-ionizers to treat boiler feed water. Maintenance of satisfactorily high pH and total removal of corrosive gases assure years of trouble-free boiler operation.

ILLCO-WAY With this same equipment you prevent boiler scale, carry-over and embrittlement—because De-ionized Water is free from dissolved solids, including silica. ILLCO-WAY De-ionizers will produce thousands of gallons of boiler feed water to your most exacting specifications for only a few cents.

ILLCO-WAY Let us give you complete facts about this new process that keeps boilers clean by ion-exchange. Read how corrosion is eliminated by this new scientific method! Write for literature today.

ILLINOIS WATER TREATMENT CO.
853-3 Cedar Street, Rockford, Illinois
7310-NN3 Empire State Bldg., New York

TESTED IN THE LABORATORY · ILLCO-WAY · PROVED IN THE FIELD

Boiler Feed-Water Treatment

Complete equipment for Chemical Processing: Purification of industrial wastes, Separation of Chemical Solutions, Purification of Chemical Solutions, Reclamation of Valuable Constituents

jection, dirty or defective nozzles, or a cold engine operating close to the misfiring region.

In engine development, there is usually a stage when exhaust smoke looms as a major problem. The cause may be merely maladjustments, as just mentioned, or design defects, which are more difficult to correct. The logical first step is smoke diagnosis, in which the chart of Fig. 1 may prove helpful.

Conclusions. Well-designed diesel engines in good repair need not smoke while being operated on normal fuels if overload is prevented. In correcting a smoky exhaust, diagnosis is the first step. To eliminate hot smoke, improve mixing of fuel and air; to eliminate cold smoke, speed up ignition.

Reader's Problems

(*Continued from page* 117)

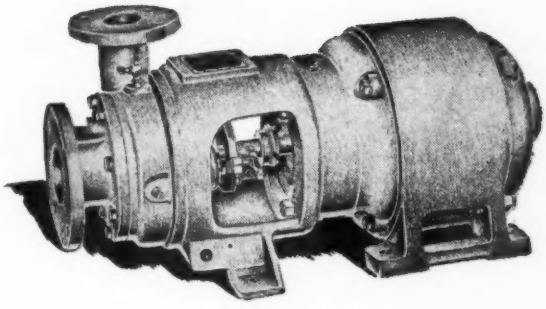
waste fan supply the secondary air.

There is a loaded damper in the line from blower to furnace to prevent flashback fires. This is especially important where the feed pipe drops almost straight down in front of furnaces as ours does. *HGP* should provide some method for preventing fires if his fan stops or the line gets plugged with large particles. There are several safety dampers or valves available for this service, so he can surely find one that will fit his installation.

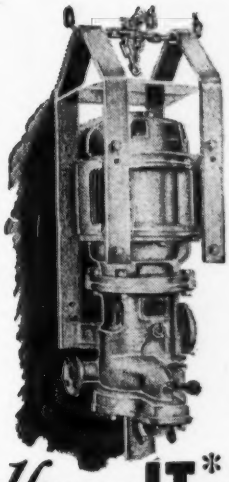
There may also be some plugging in his flue-gas passages, especially if they are small or the boiler is being forced. We found it necessary to rearrange the baffles when waste burning was started as some of the unburned particles were carried over into the second pass and deposited there.

St Louis, Mo. C J HAMILTON

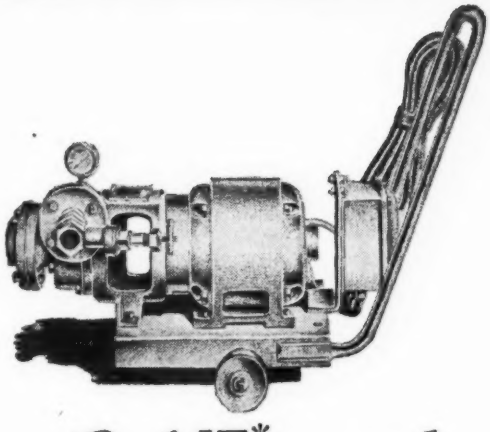
Dr Vannevar Bush, president of Carnegie Institution of Washington and wartime director of Office of Scientific Research and Development, has been named 1946 winner of the Hoover Medal, jointly awarded by four national engineering societies. It was formally conferred on Dr Bush on Jan 30 in auditorium of Engineering Societies Bldg, 29 W 39th St, New York, N. Y., at winter meeting of American Institute of Electrical Engineers. This society confers the award jointly with American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers and American Society of Mechanical Engineers. These four national organizations, with a total membership of more than 82,000, are known as the engineering "founder" societies.



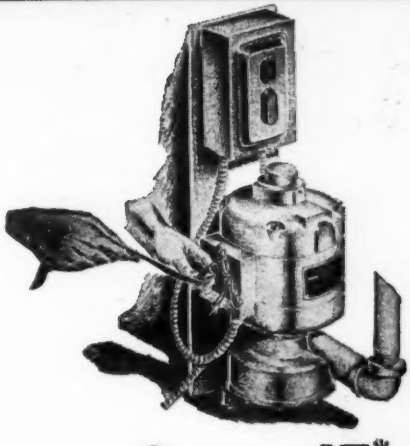
Set **IT*** *down*



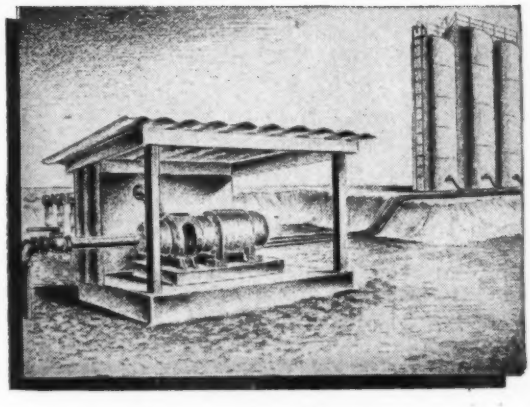
Hang **IT*** *up*



Push **IT*** *around*



Connect **IT***



Leave **IT*** *alone*

*** IT is the MOTORPUMP**

the rugged utility unit that works in any position, is at home in any industry, and takes punishment like a seasoned trouper.

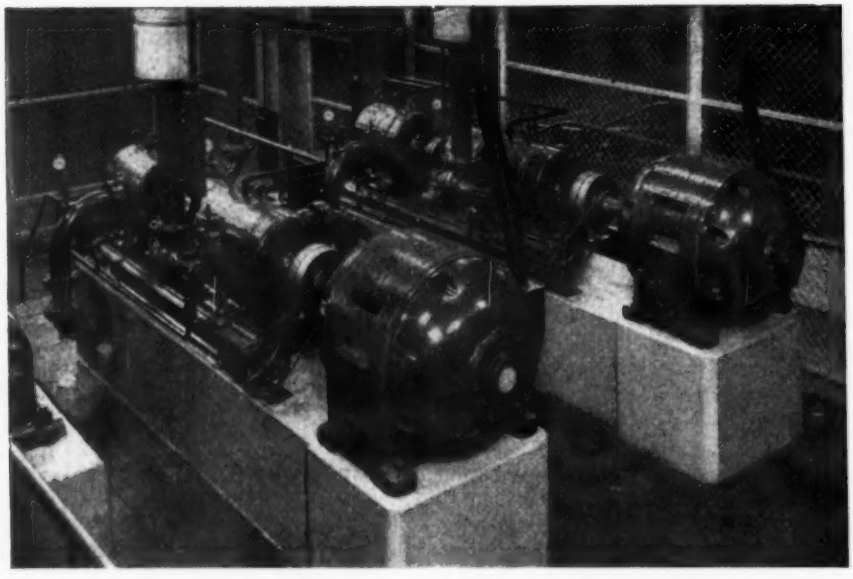
➡ Sizes: ½ to 50 hp; 5 to 1800 gpm; 5 to 600 ft head; . . . . Materials to suit your conditions

Ask our nearest branch for Form 7093, the Motorpump Catalog.

It's an eye-opener on pump versatility.

Ingersoll-Rand

Cameron Pump Division 9-933
11 Broadway, New York 4, N. Y.



FULLER ROTARY INSURANCE

MAINTAINED CAPACITY FOR THE LIFE OF THE MACHINE

NO LEAKING VALVES OR GRINDING OF SEATS

NO BEARING TAKE-UP

ACCESSIBILITY

SMALL FLOOR SPACE WITH RELATION TO CAPACITY

NO AIR-LINE PULSATIONS

SIMPLE FOUNDATIONS

NO MULTIPLICITY OF PARTS REQUIRING FREQUENT ATTENTION, ADJUSTMENT AND REPLACEMENT.

Dependable performance assured with Fuller Rotary Compressors. Hundreds of satisfied users have found this out during the past few years. Also, in practically every instance, once a Fuller Rotary is installed and additional air is required, other Fullers follow.

We invite your inquiries and investigation . . . become better acquainted with Fuller Rotary Compressors and Vacuum Pumps.

FULLER COMPANY, CATASAUQUA, PA.
Chicago, 3 - 120 So. LaSalle St.
San Francisco 4 - 421 Chancery Bldg.
Washington 5, D. C. - 618 Colorado Bldg.

C-145

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

New Equipment

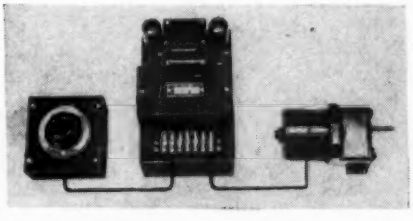
(*Continued from page* 134)

removable with it, without disturbing piping connections. Valve, seat and lever pins are stainless steel. Trap is built in pipe sizes ½, ¾ and 1 in. for pressures up to 200 psi. **Dept P, Hoffman Specialty Co, 1001 York St, Indianapolis 7, Ind.**

Chemical Feeder

SERIES OF MICROMET FEEDERS consists of large units holding up to 20, 50 or 100 lb of chemical. Chemical dissolves slowly, about 25% per month, so only that much of initial charge need be replenished each month.

Size of feeder required depends on water trouble encountered and amount to be treated. When treating for corrosion, the 50-lb feeder handles up to 150,000 gal per month; for scale prevention, quantity handled is about doubled. **Dept. P, Calgon Inc, 323 Fourth Ave, Pittsburgh 30, Pa.**



Servocontrol

SYNCHRO-LINK is a remote-control system that positions one or more motors according to transmitter setting. Manufacturer says accuracy is independent of load and is better than 1% of full range.

Device, which operates on self-balancing electronic-bridge principle, consists of a master control, electronic controller and load-control potentiometer. Controller contacts will handle 15-amp 110-v, or 10-amp 220-v ac. Motors up to ⅓₀ hp can be connected directly; larger ones use a standard reversing starter. **Dept P, Yardeny Laboratories Inc, 105 Chambers St, New York 7, N. Y.**

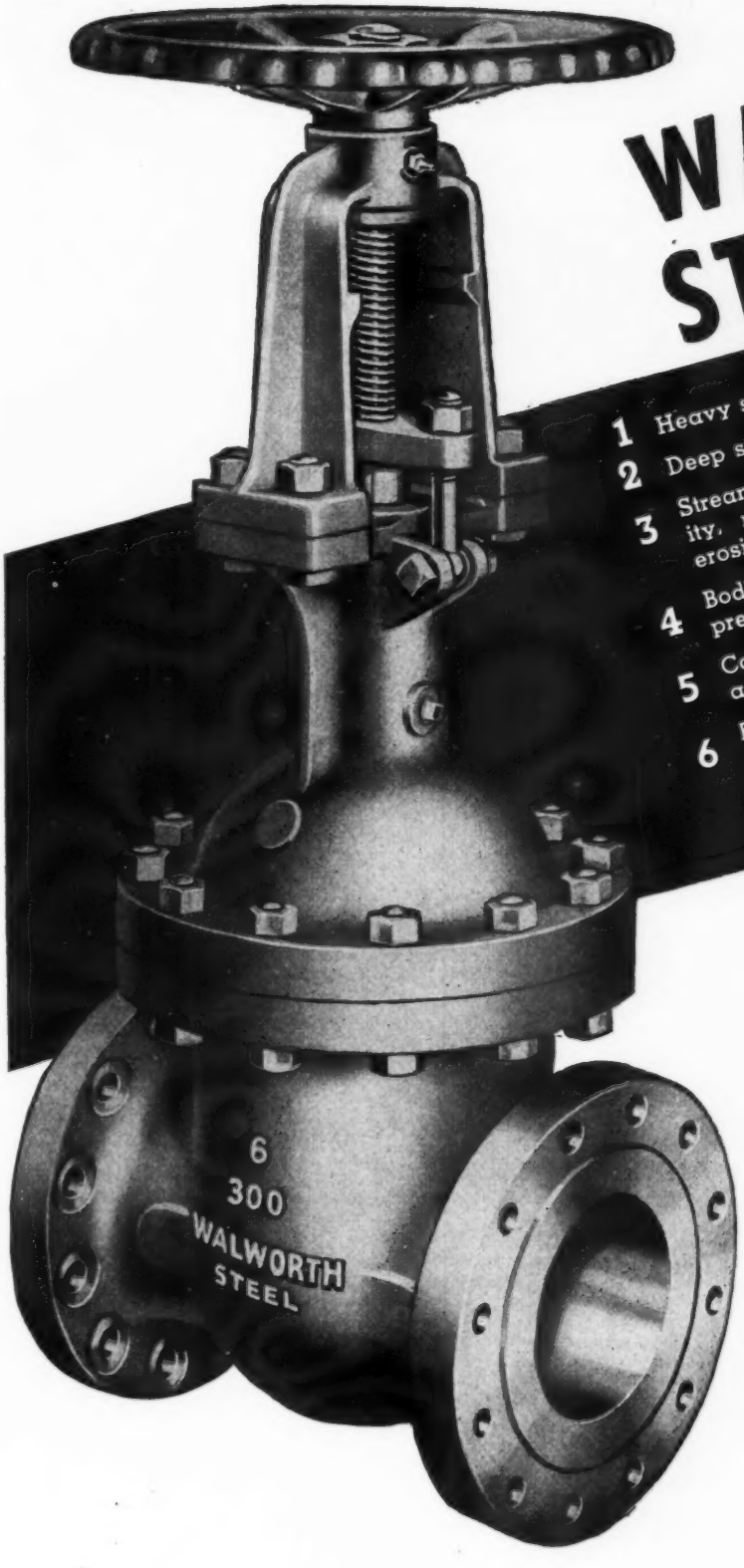
Vernier Caliper

NEW TOOL is a combination outside and inside caliper and depth gage with all appearing on same vernier. Device can be supplied with either metric or English scale, reading to 0.0001 in. A thumbscrew locks slide at any desired position. **Dept P, Park Sales Co, 417 Canal St, New York 13, N. Y.**

Aid for Wounds, Burns

CONCENTRATED, SULFHYDRYL ION stimulates healing of flesh wounds and burns, claim the manufacturer of *Hydrosulphosol*. Quoting a statement of the *American Journal of Surgery* that a high concentration

You get all these BIG features in WALWORTH STEEL VALVES



1. Heavy steel walls for extra strength and protection.
2. Deep stuffing boxes to eliminate costly leaks.
3. Streamlined ports to make possible a high velocity, non-turbulent flow, and reduces possible erosion.
4. Bodies and bonnets engineered to withstand pressure and minimize distortion.
5. Cast body guide rib faces, machined to insure accurate disc centering.
6. Exact design, metallurgy and construction of yoke nuts, bonnet bushings, gland followers, handwheels and other vital parts to assure better service for a longer period of time.

Is there any wonder that out in the field, where approval is based on performance under actual operating conditions, industry has put its O.K. on Walworth Steel Valves?

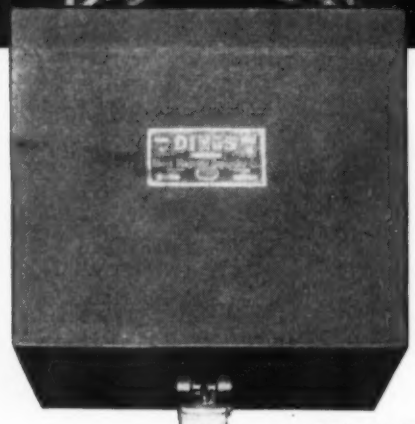
Tough . . . wear resistant . . . dependable, these valves are produced in gate and globe types, in sizes to cover practically every service requirement. They are excellent examples of Walworth leadership . . . leadership that has made the Walworth valves famous throughout the world.

Walworth Catalog 42 gives complete information regarding Steel Valves as well as the full line of Walworth valves and fittings in bronze and iron. Your copy may be obtained upon request. Whenever you need valves — whether steel, bronze or iron — remember Walworth for dependability, economy, and long service life.

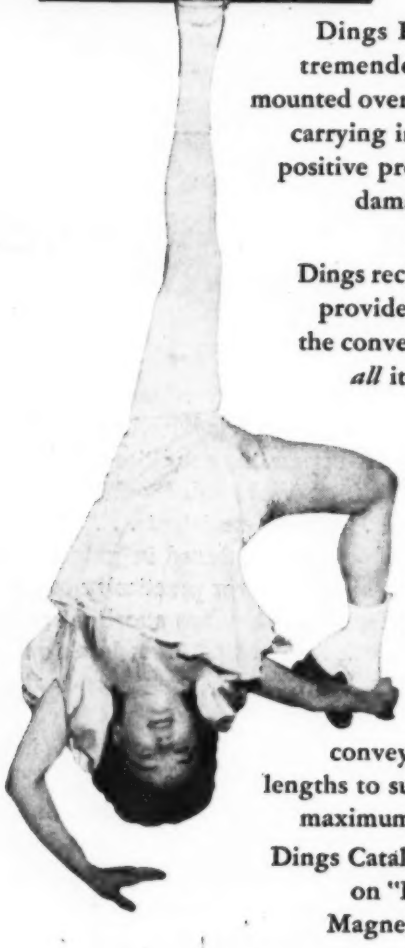
WALWORTH
valves and fittings
60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Magnetic Strength



for POWER PLANT PROTECTION *against* TRAMP IRON DAMAGE



As illustrated here, Dings Rectangular Magnets have tremendous "pickup" ability—and mounted over fast-moving conveyor belts carrying incoming coal, they provide positive protection against tramp iron damage to crushers, pulverizers, screens, stokers and grates.

Dings rectangular, double-gap design provides a magnet—no wider than the conveyor belt—that concentrates *all* its "High Intensity" strength on the material carried beneath it. Eliminating overhang puts the magnetic lines of force to work where they belong—and cuts operating costs by allowing a smaller magnet to do a bigger job. Rectangular magnet sizes are available to fit most conveyor belt widths, with magnet lengths to suit belt loads and speeds for maximum iron-removal effectiveness.

Dings Catalog 301 gives complete data on "High Intensity" Rectangular Magnets. *Write for your copy today.*

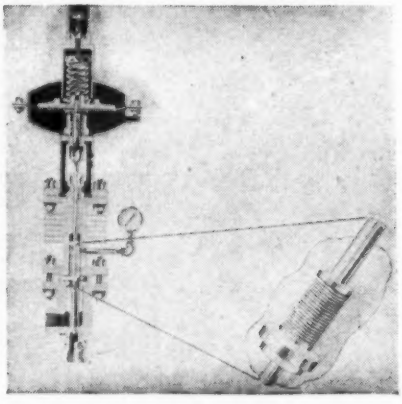
DINGS MAGNETIC SEPARATOR CO.

4765 W. McGeogh Avenue
Milwaukee 14, Wisconsin

"Magnetic Separation Headquarters Since 1899"

Dings MAGNETIC SEPARATION HIGH INTENSITY

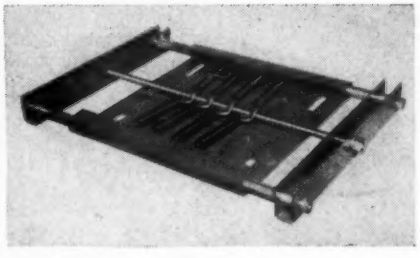
of sulfhydryl ion together with glutathione promotes rapid healing, manufacturer states this product treats flesh wounds and abrasions as well as thermal, acid and caustic burns. It comes in two forms, a spray solution or a cream-base ointment. **Dept P, Davis Emergency Equipment Co, 177 Halleck St, Newark 4, N. J.**



Packless Control Valve

BELLOWS-SEALED VALVE STEM eliminates packing gland in the 3000 *B* series diaphragm-control valve, and can be furnished in any size and body for pressures up to 500 psi and temperatures from —70 to 750 F.

Bellows unit is retained between two stainless-steel gaskets by bonnet assembly. A modified packing gland serves as an emergency seal should bellows fail mechanically or through corrosion. A telltale pressure gage can be provided to indicate bellows failure. Unit is available in 2-ply *Type* 347 stainless steel as standard, and may be mounted on any size screwed-end valve from ¼ to 1½ in. and on flanged-end valves from 1½ to 12 in. **Dept P, Hammel-Dahl Co, 243 Richmond St, Providence 3, R. I.**



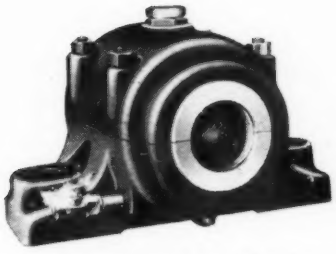
Small Motor Base

AUTOMATIC MOTOR BASE consists of flat steel plate mounted on guide rods, secured in two headers. For bolting motor to base, holes are slotted to permit motor alignment. Belt tension is maintained by one or more pairs of springs attached to under edge of base and to wingnuts on central adjusting screw. Screw provides for any desired tension in belt, which is then maintained by springs.

Base's simplicity and low cost adapts it to smallest-size motor driving through belts. Motor practically floats against spring tension so that correct belt tension is maintained at all times, regardless of kind of

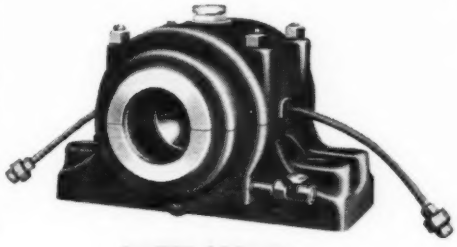
(*Continued on page* 178)

FAN AND BLOWER BEARINGS



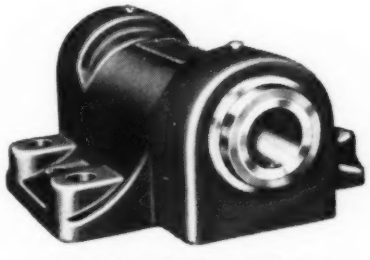
SLEEVOIL PILLOW BLOCK

A precision-built, ring-oiling babbitted bearing, self-aligning and exceptionally quiet. Special seals prevent oil leakage and keep dirt out. Field-proved by thousands of installations.



WATER-COOLED SLEEVOIL PILLOW BLOCK

Designed for applications where higher temperatures are encountered. Shaft sizes from 1-11/16" to 8". Widely used under industry's toughest operating conditions.



DH BALL BEARING FAN AND BLOWER PILLOW BLOCK

Single row, deep groove ball bearings for No. 2 arrangement. Inner race extended to form sleeve which carries shaft. Piston ring seals retain lubricant, exclude dirt. Shaft sizes 15/16" to 2-1/4". A favorite where compactness is at a premium.

BRONZOIL PILLOW BLOCK

Capillary bronze bushing has capacity of one-third its volume in oil. Reservoir with close fitting wick around bushing provides ample lubrication. Oil resistant and static proof grommets available for noise isolation. Sizes 1/2" to 1-1/4". America's standard for light applications.

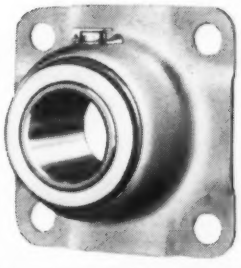
America's Most Complete Line

Working closely with air conditioning equipment manufacturers, Dodge of Mishawaka has developed bearings to meet the exacting operating conditions encountered in this industry. Cost-saving products for the mechanical transmission of power are manufactured by Dodge for use in all industries.

DODGE MANUFACTURING CORPORATION • MISHAWAKA, INDIANA

DODGE

of Mishawaka, Ind.



BRONZOIL FLANGED BEARING

Mounted in heavy gauge steel flanged housing this bearing has the basic Bronzoil construction and characteristics as described at the left. Sizes 1/2" to 1-1/4". A proven performer in a new mounting.

CALL *THE TRANSMISSIONEER*

your local Dodge distributor, for information about the line of Dodge bearings for fan and blower service—and for news about Dodge products to cut costs and increase production in all industries. Look for his name under "Power Transmission Equipment" in your classified phone directory.

Copyright, 1947, Dodge Mfg. Corp.

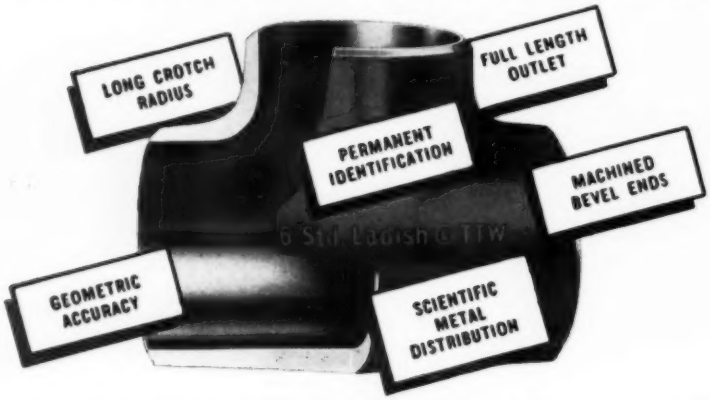
NAME PLATES

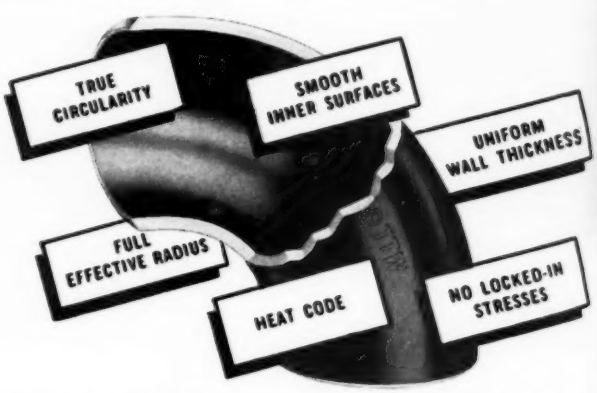
FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

LADISH Presents an IMPORTANT NEW DEVELOPMENT

Controlled Quality SEAMLESS WELDING FITTINGS

These Outstanding Ladish Features Increase Piping Efficiency and Assure Greater Reliability





UNIFORM GRAIN STRUCTURE—The finer, more uniformly compact metal structure of Ladish Seamless Welding Fittings substantially increases their dynamic strength and toughness . . . while rigid control of melting processes gives added protection against brittleness at low temperatures and provides increased resistance to distortion at high temperatures. The dense, homogeneous grain structure also provides measurably greater resistance to corrosion and erosion.

HEAT CODE IDENTIFICATION—The heat code symbol, a permanent identification on Ladish Seamless Welding Fittings, is your assurance of complete metallurgical integrity and responsibility. Through this exclusive feature, Ladish's customers can obtain upon request, certified metallurgical reports giving complete chemical composition and physical properties of the particular steel from which any Ladish Fitting is made.

LONGER SERVICE LIFE—Ladish advanced processes assure greater strength by accurately controlling the distribution of metal in accordance with the requirements of each type of fitting. The wall thickness of Ladish Elbows and Return Bends is uniform throughout . . . in Ladish Tees, wall thicknesses are scientifically proportioned to yield uniform stresses at all points.

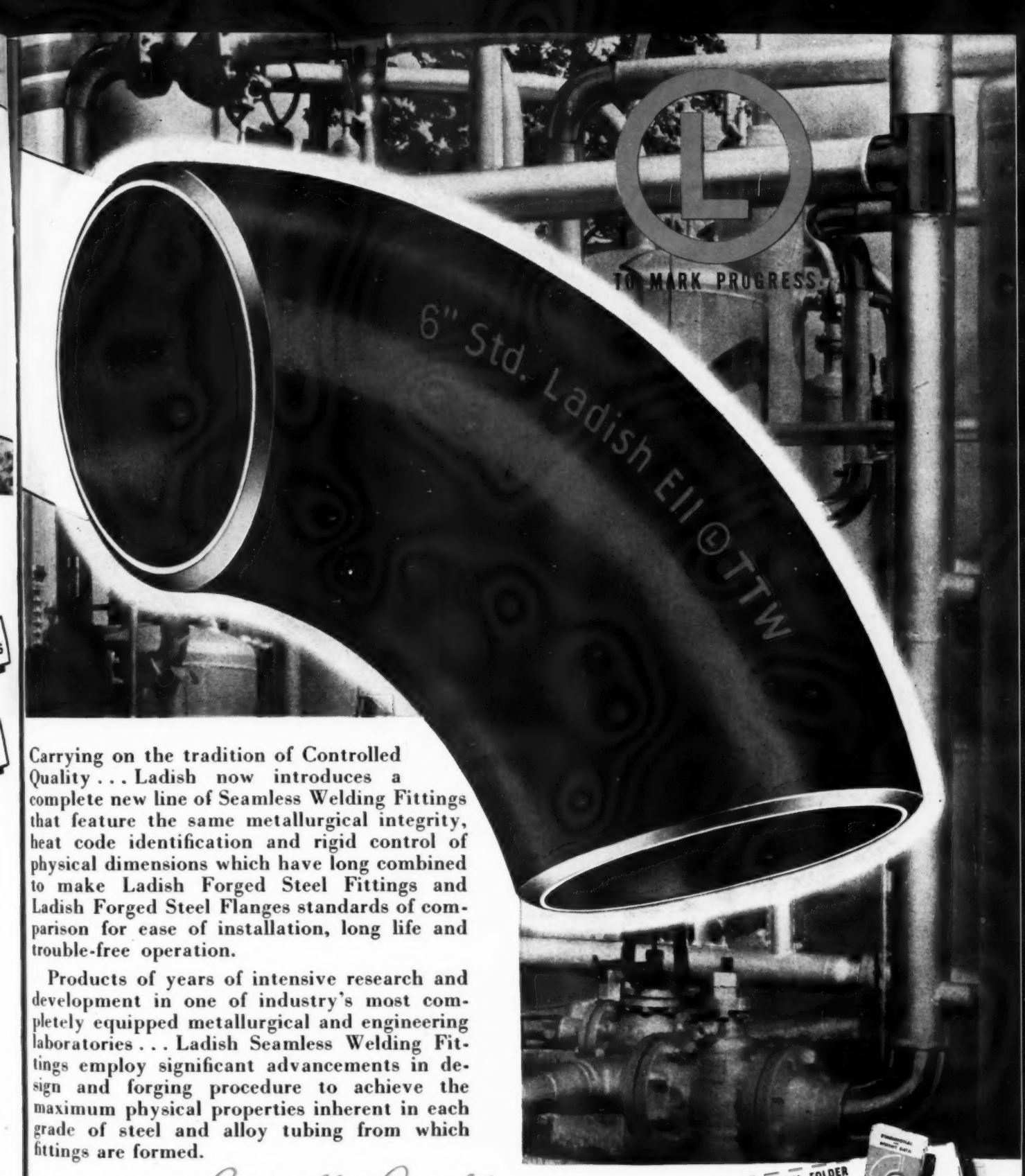
REDUCED PRESSURE LOSS—Easy sweeping curves, smooth inner surfaces, true circularity, and full effective radii reduce friction and pressure losses to a minimum.

PERFECT ALIGNMENT—Uniform wall thickness, full circularity, and accurately machined ends insure quick, accurate alignment.

ASSURED WELDABILITY—Close metallurgical control protects against harmful impurities in metal, thus assuring sound homogeneous welds. Full length outlets on Tees provide greater welding accessibility.

SIMPLIFIED PIPING MAKE-UP—Ladish Fittings are geometrically true in all planes. Their accuracy of dimensions and included angles facilitates economical fabrication and insures truer, neater piping assemblies with greater flow efficiency.

Stocked and Sold by Authorized Ladish Distributors in Principal Centers.



Carrying on the tradition of Controlled Quality . . . Ladish now introduces a complete new line of Seamless Welding Fittings that feature the same metallurgical integrity, heat code identification and rigid control of physical dimensions which have long combined to make Ladish Forged Steel Fittings and Ladish Forged Steel Flanges standards of comparison for ease of installation, long life and trouble-free operation.

Products of years of intensive research and development in one of industry's most completely equipped metallurgical and engineering laboratories . . . Ladish Seamless Welding Fittings employ significant advancements in design and forging procedure to achieve the maximum physical properties inherent in each grade of steel and alloy tubing from which fittings are formed.

Controlled Quality

FITTINGS

LADISH CO.

CUDAHY, WISCONSIN

MILWAUKEE SUBURB

DISTRICT OFFICES:

New York • Buffalo • Pittsburgh • Cleveland • Chicago • St. Louis • Houston • New Orleans • Los Angeles

FREE VALUABLE DIMENSIONAL FOLDER

LADISH CO.
Dept. P-3
Cudahy, Wis.

Please send me the handy 10-page data folder giving dimensions, weights and part numbers of Ladish Seamless Welding Fittings.

Name .....

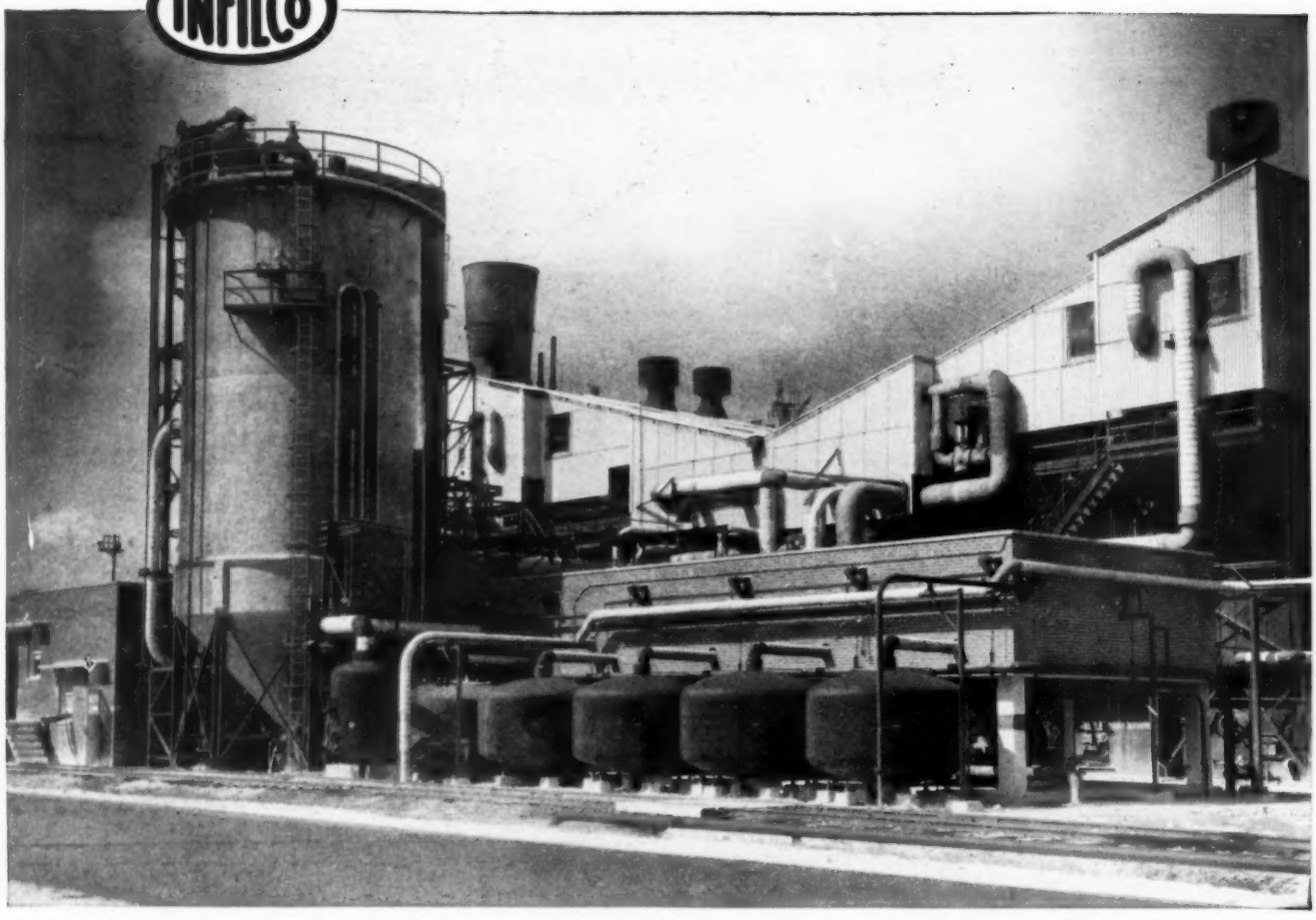
Title .....

Company .....

Address ..... Zone ... State .....

City .....

INFILCO



INSTALLED WHEN BUTADIENE PRODUCTION WAS A "MUST"—

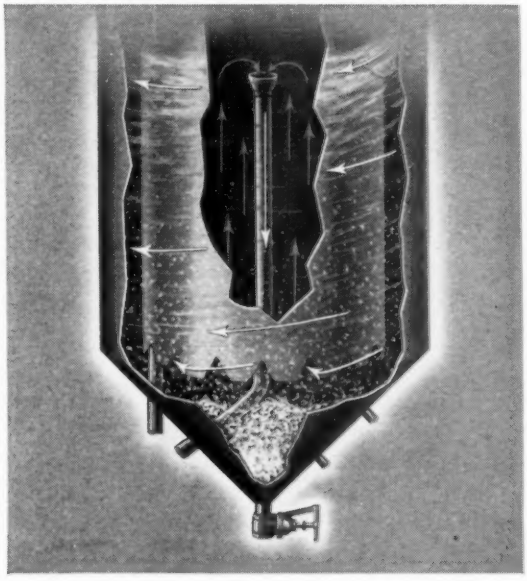
this 500,000 lb. per hour deaerating Hot-Flow Softener continues to make record refinery runs possible.

Handling a high silica water which, used untreated, would cause plenty of boiler room grief, this Hot-Flow Softener makes possible the continuous, trouble-free boiler operation so necessary to high production quotas.

Large or small, Infilco Hot-Flow Softeners incorporate design features which assure maximum treatment results with minimum attendance and overall operating costs.

If water—for boiler feed or other purposes—is one of your production "bottlenecks", it will pay you to find out what Infilco equipment can do for you in your plant.

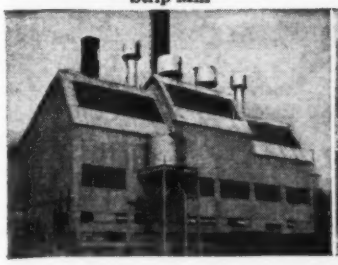
When would you like to have one of our engineers call? INFILCO Inc., 325 West 25th Place, Chicago 16, Illinois.



It's the *internal* design that produces *better* chemical mixing, *better* solids separation and *better* sedimentation in the Hot-Flow Tank.

Thorough mixing of chemicals and thorough sedimentation in this tank always insure an adequate volume of properly treated feed water ahead of the filters.

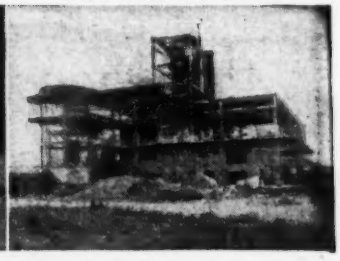
CONSULT INFILCO — FIRST IN WATER AND TRADE WASTE TREATMENT



Complete Boiler Plant for Large Strip Mill

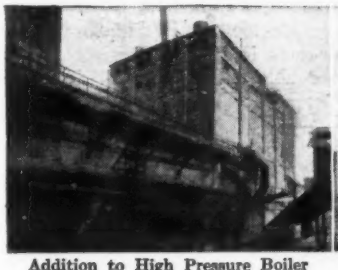
Boilers and Firing Equipment in Strip Mill Boiler Plant

Turbogenerators in Plant of Eastern Food Producer



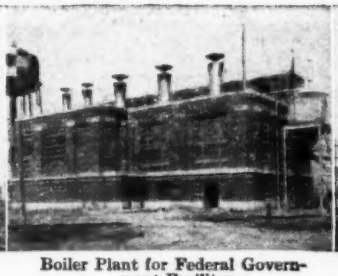
Boiler and Compressor Plant for Automotive Manufacturer

POWER
FOR ALL INDUSTRY

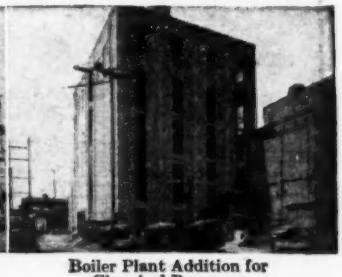


Addition to High Pressure Boiler Plant for Steel Producer

Power Plant Construction at Large Midwestern Petroleum Refinery



Boiler Plant for Federal Government Facility



Boiler Plant Addition for Chemical Processor

THROUGHOUT the field of industrial building the complete coordination of separate elements is never more important than in boiler and power plant construction. Many types of equipment and many specialized building operations must be fitted into the pattern specified by the consulting engineer.

Here, in the construction of power and boiler plants, the skill of the builder can be the most important ingredient of efficient and successful operation. Here, the specialists in power and boiler plant construction can be of greatest service to all industry.

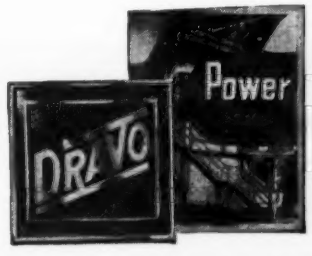
Dravo Corporation builds complete power plants. Typical examples of Dravo-built power and boiler plants can be found in steel mills, food processing plants, oil refineries, Federal and Municipal institutions, automotive manufacturers, chemical processors. Many of these installations were built by Dravo under contracts which involved total responsibility for building and installation of equipment; other projects included installation of major items of equipment.

Dravo Power Plant Specialists can be of real service in carrying out your plans. Wherever you need boiler or power plant construction or modernization—Call Dravo.

Bulletin BI-504 describes, in detail, how DRAVO power and boiler plant construction experience will serve you.

DRAVO CORPORATION

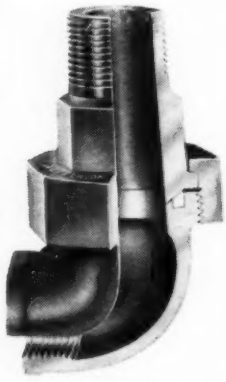
PITTSBURGH • WILMINGTON • PHILADELPHIA
WASHINGTON • NEW YORK
DETROIT • CLEVELAND



Power and Boiler Plants — Pumping Stations — Power Plant and Contractor's Equipment — Direct-Fired Heaters — Industrial Heating and Ventilating
Bridge Substructures — Docks — Pump Houses and Intakes — Mill Foundations — Locks and Dams — Shafts, Slopes and Tunnels — Towboats and Barges
Coal and Ore Bridges — Cranes and Derrick Boats — Crane Cab Coolers — Open Steel Flooring — Concrete Aggregates — Inland River Transportation

Reduce Installation and Maintenance Costs with

JEFFERSON SPECIALTY UNIONS



Jefferson Specialty Unions are available in types which are designed to simplify piping and effect definite savings in time, labor and materials in making up joints. The 90° Union Elbow illustrated is but one of the many types in the complete Jefferson line.

Maintenance savings, too, are assured through the use of these unions, because fewer joints are involved at points where they can be applied to advantage. The Recessed Brass Seat, an exclusive feature of Jefferson Unions, accounts for ease of installation and maintenance. The seat provides a leak-tight joint without undue pressure and can be made or broken, time after time if necessary, without losing its effectiveness.

. . . the UNION with the RECESSED BRASS SEAT

Your nearest distributor will furnish details . . . or write us direct.

JEFFERSON UNION CO.

601 WEST 26th STREET, NEW YORK 1, N. Y.

LEXINGTON 73, MASS. LOCKPORT, N. Y.

4 ROUNDS---TO A K.O.

NCC

SLUDGE SOLVENT AND FUEL OIL CONDITIONER

No need to put up with sludge-fouled oil tanks and strainers, sludge-clogged burner tips and feed lines, sludge-carbonized preheater coils. NCC ends all that forever. NCC has never failed in 14 years use by factories, ship lines and railroads. Sold with money-back guarantee.

NUTMEG CHEMICAL CO., 223 State St., New Haven 10, Conn.

load or direction of motor rotation. As belt stretches from normal use and wear, its tension is easily adjusted by a few turns of the screw, while motor is running. Base serves for all size motors up to 15 hp. **Dept P, Automatic Motor Base Co, P O Box 2186, Paterson, N. J.**

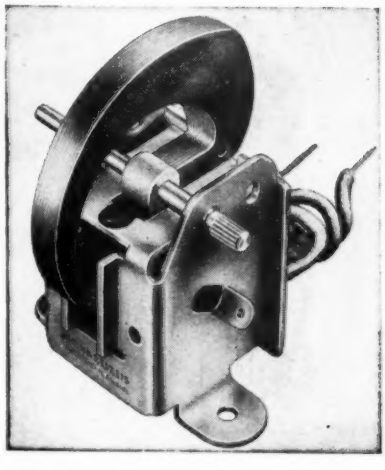
Water Heater

THERMOSTATICALLY CONTROLLED mixing valve connects directly to steam and water lines to supply heated water for shower and washroom. Using steam at 75 psi the device heats 200 gal per hr from 50 to 120 F. Body is brass, with valve heads and seats of stainless steel. Cold water and steam inlets have union connections. **Dept P, Sarco Co, 475 Fifth Ave, New York 17, N. Y.**

Nickel-Clad Steel

ROLLED NICKEL- AND MONEL-CLAD steel strip is available in widths from ¼ to 10¼ in. Thickness ranges from 0.010 to 0.125 in. for cold-rolled and 0.095 to ½ in. for hot rolled material.

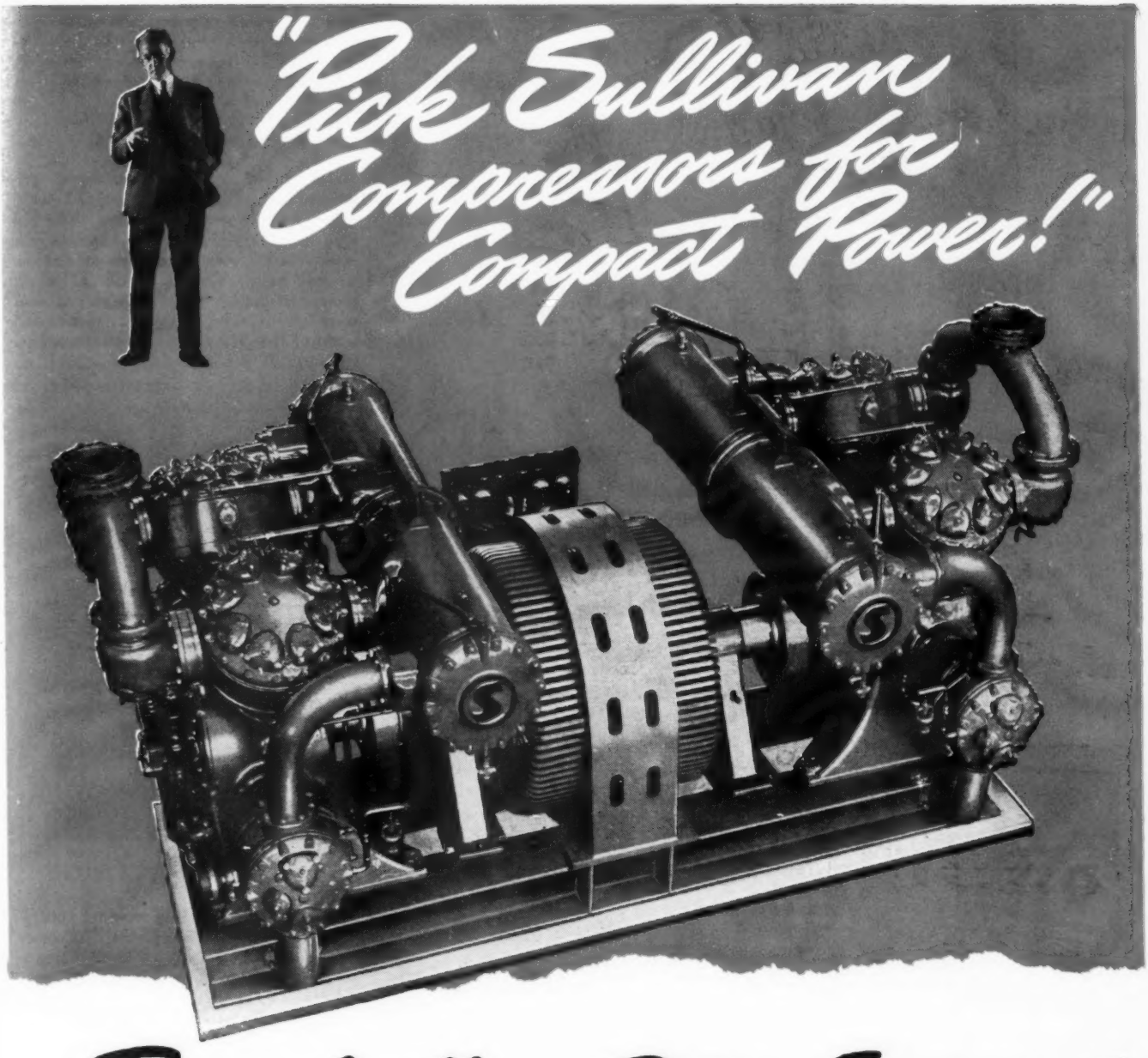
The strip can be furnished either single or double clad. Standard cladding thickness is 10% on single clad and 20% on double clad. **Dept P, Superior Steel Corp, Carnegie, Pa.**



Solenoid Motor

A UNIQUE POWER DEVICE which operates as a solenoid except that it rotates through 180 deg, this *Rotonoid* produces torque instead of a thrust and consequently eliminates necessity of connecting linkages. Armature maintains a constant heavy-duty torque throughout its entire 180-deg path. Originally designed for operation of radio-tuning units, *Rotonoid* has widespread application in many fields ranging from electromagnetic valves to adding and calculating machines.

Entire unit is self-contained in 2½x2⅝x3¼ in. and weighs only 10 oz. Standard units have a torque of 16 in.-oz and can be operated continuously at 20 cycles per min without exceeding a safe temperature. On faster action they can be used at 60 cycles per min for periods up to 12 min on 115-v 60-cycle ac. A current interrupter can be



Rugged...Heavy Duty...Economical

WN-114 COMPRESSOR

TAKES LESS FLOOR SPACE—HAS HIGHER CAPACITY

DELIVERING AIR UP TO 3,656 CFM

SULLIVAN

PORTABLE AND STATIONARY AIR COMPRESSORS

W&D I 504

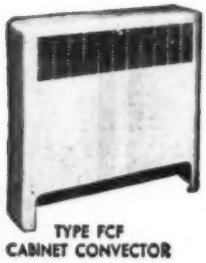
Consult a Joy Engineer

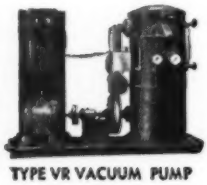
SULLIVAN DIVISION

JOY MANUFACTURING CO.

GENERAL OFFICES: HENRY W. OLIVER BUILDING, PITTSBURGH, PA.

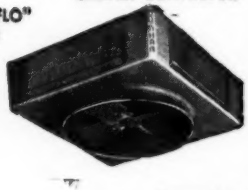
Whatever the name of your present heating "team", it will develop new efficiency, new economy . . . when you replace inefficient parts with Dunham low pressure and atmospheric steam heating specialties. Dunham products are precision engineered of quality materials, designed to fit into your present heating system and help give you better more economical heating performance over a longer period of time. Write for Bulletin 634. C. A. DUNHAM COMPANY, 450 East Ohio Street, Chicago 11, Illinois.


TYPE FCF CABINET CONVECTOR


TYPE VR VACUUM PUMP

TYPE WCF CABINET CONVECTOR

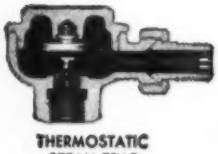
TYPE C "DOWNFLO" UNIT HEATER



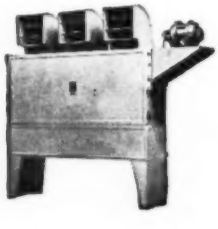
THERMOSTATIC FLOAT TRAP

NO. 1140 PACKLESS VALVE

TYPE V UNIT


THERMOSTATIC STEAM TRAP

TYPE R UNIT HEATER



NO. 1 TRAP

P347-2/38

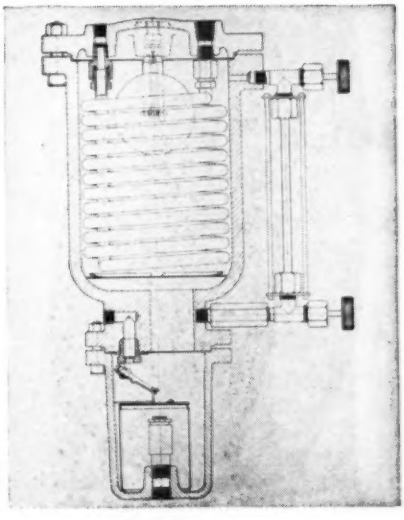
DUNHAM

HEATING MEANS BETTER HEATING

attached, which operates automatically, at the end of each stroke, thus holding temperature rise to a minimum. **Dept P, Radio Condenser Co, Camden, N. J.**

Diamond Grinding Wheel

RESIN-BONDED WHEELS of diamond grit grind carbides and carbide-tipped tools. Manufacturer says resin bond does not load or glaze when wheel contacts soft or hardened tool-steel shanks of carbide-tipped tools. Complete line of wheel types and shapes is available in grit sizes from 60 to 400. **Dept P, Manhattan Rubber Div, Raybestos-Manhattan, Inc. Passaic, N. J.**



Gas Purger

NEW GAS PURGER uses an internal coil instead of a refrigerating jacket. Efficiency is said to range from 98 to 100%. Device incorporates a new noncondensable gas-discharge mechanism in which the ball float, used to actuate valve, has been enlarged, and valve improved.

No. 270 serves for pressures up to 200 psi and the No. 370 up to 300 psi. **Dept P, Armstrong Machine Works, 812 Maple St, Three Rivers, Mich.**

Fire Data Guide

SLIDE-RULE GUIDE gives facts about suitability, maintenance and performance of soda-acid, foam, pump-tank, dry-powder, loaded-stream, carbon-tetrachloride and carbon-dioxide fire extinguishers. Reverse side tells how high the units should be mounted, maximum distance of extinguisher from operator and area protected by each unit. **Dept P, Randolph Laboratories, Inc, 8 E Kinzie St, Chicago 11, Ill.**

Tube-Cleaner Motor

TWO TUBE-CLEANING MOTORS called *Roto Air Jet* and *Roto Water Jet* are driven by air and water respectively. Manufacturer says improved design shows increased power with less fluid consumption. Existing *Roto* cutter heads and supply hose fit

Whatever your piping needs

SHAW

fills them quickly, dependably

KNOWN SINCE 1893 FOR HIGH QUALITY

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

President

BENJAMIN F. SHAW CO.

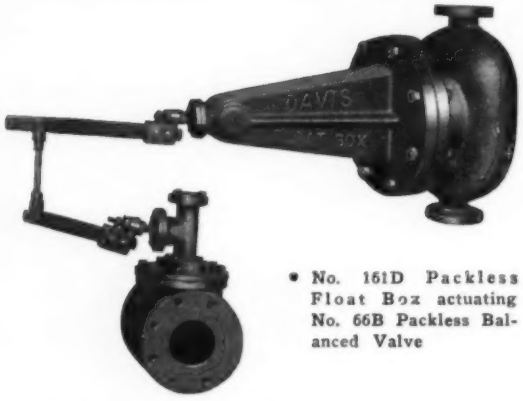
Second & Lombard Sts., Wilmington 99, Del.

dependable

PIPING

pre-fabrication and installation

FLOAT BOXES



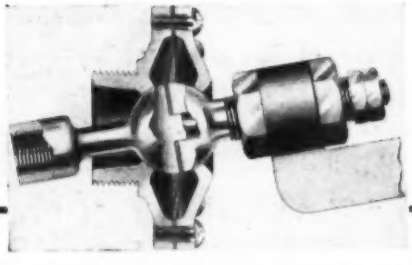
• No. 161D Packless Float Box actuating No. 66B Packless Balanced Valve

FOR LIQUID LEVEL CONTROL SERVICE

DAVIS Float Boxes are used in connection with closed tanks where fluctuation of the fluid level within the tank is the governing factor in the control of all types of electrical switches, control valves, pilot valves, (for operation of diaphragm motor valves), motors and other equipment. Davis fluid control equipment also includes internal float units for direct or pilot operation. Whatever your requirement may be, Davis can supply you with a combination of float box and control valve to make your control accurate, positive, and dependable.

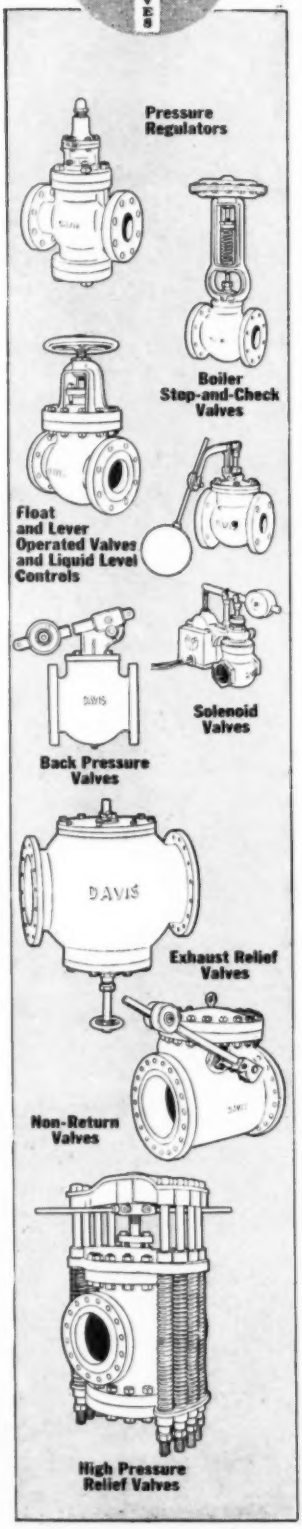
Drop us a card today for detailed information on the Davis line. Ask for Bulletin 101AA.

DAVIS DIA-BALL TRANSMISSION UNIT



A patented, leakproof, corrosion resistant packless assembly eliminating the packing box on Davis Float Boxes and Control Valves. Especially recommended for vacuum service or for use with volatile and inflammable fluids where a packing box is objectionable because of leakage. For pressures up to 300 lbs. and temperatures up to 450° F.

DAVIS VALVES



DAVIS REGULATOR CO.

Representatives in All Principal Cities

2540 S. WASHTENAW AVE., CHICAGO 8, ILL.

new jet motors, which are available for most common tube sizes. Other sizes are being added. **Dept P, Roto Div, Elliott Co, Newark 1, N. J.**

Flexible-Metal Hose

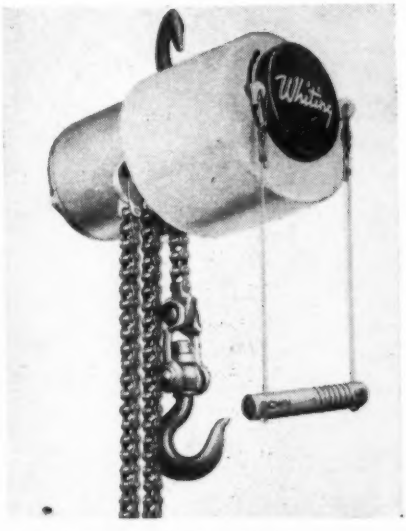
NEW FLEXIBLE-METAL HOSE, $\frac{1}{8}$ in. in diameter, can be furnished in bronze, steel and various alloys. Hose is suitable for a protective casing on industrial instrument capillary tubes, or as a covering for wire and cable. **Dept P, Pennsylvania Flexible Metallic Tubing Co, Philadelphia, Pa.**

Blower and Cleaner

SEALED BALL-BEARING MOTOR, one-hp capacity, powers a streamlined blower with a baked enamel finish. No. 77 model blows, vacuums, sprays under control of a 2-speed switch. Unit, guaranteed for a year, carries an Underwriters' Laboratories seal of approval. **Dept P, Holub Industries, Inc, Sycamore, Ill.**

Air Eliminator

EXPANSION OF LINE OF RISSELT air-eliminator valves includes a new device for industrial use that is applicable to all steam processing. It can be used on pressures up to 125 psi. **Dept P, Special Products Div, Lodge & Shipley Co, Cincinnati, Ohio.**

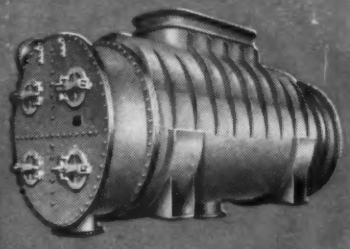


Portable Electric Hoist

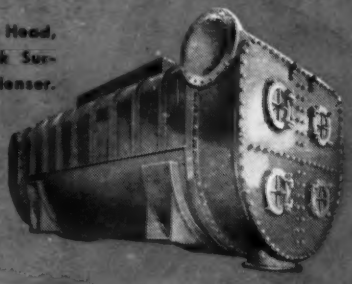
LINE OF LIGHT-WEIGHT roller-chain portable electric hoists includes $\frac{1}{4}$-, $\frac{1}{2}$- and 1-ton capacities. The 1-ton design weighs only 87 lb, light enough for one man to install or move without assistance. Light weight and compactness is made possible by use of double-reduction worm-gear drive. All bearings are ball type.

Self-energizing motor brake interlocks with controller to provide safe operation, in combination with upper and lower safety limit switches. One hand, single-bar-grip control leaves other hand free to steady load.

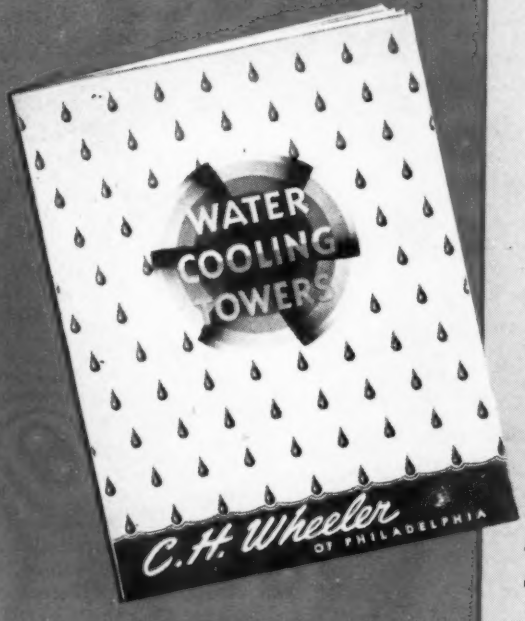
Hoist can be operated in inverted position, an advantage where overhead suspen-



Standard Type, Dual Bank Surface Condenser of Medium Size.



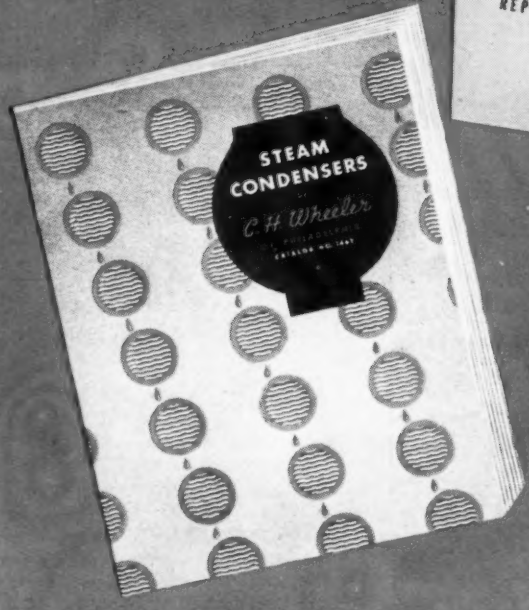
Low Type Head, Dual Bank Surface Condenser.

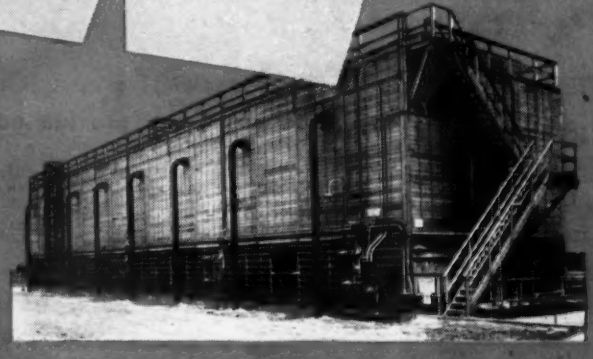


NEW CATALOGS

New 44-page Catalog No. 1461, entitled "Steam Condensers" describes and illustrates the wide range, both in types and sizes, of C. H. Wheeler "Dual Bank" Surface Condensers; also Jet Condensers of Low Level and Barometric types, which are serving hundreds of utility and industrial power plants. There are also pages of useful engineering information, tables, charts, etc. . . . Recent 20-page Catalog No. 145, entitled "Water Cooling Towers" shows the scope, in design and construction, of cooling towers "Wheeler engineered" for any climatic condition. Write for a copy of the catalog you need. If your specific condition is not described in either catalog, Wheeler engineers will gladly discuss your condenser or water cooling tower requirements. Write for further information.

C. H. WHEELER MANUFACTURING CO.
1800 SEDGLEY AVE., PHILA. 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES



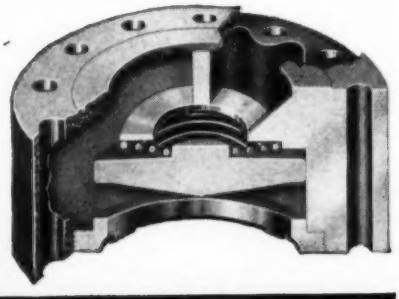


Water Cooling Towers of both induced and forced draft types, correctly engineered for any climatic conditions.

C.H. Wheeler OF PHILADELPHIA

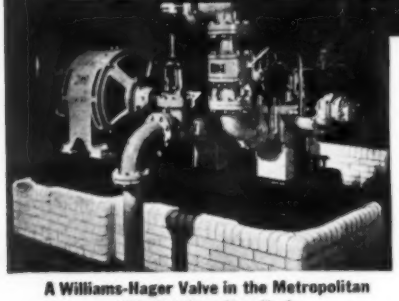
STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS

THIS NEW INFORMATIVE CATALOG WILL SOLVE YOUR "WATER HAMMER" Problem!



WILLIAMS-HAGER

FLANGED Silent
CHECK VALVES



A Williams-Hager Valve in the Metropolitan Life Building, New York.

- Precision Engineered
- Economical
- Efficient
- Frictionless
- Tight Under Every Operating Condition or Pressure up to 6000 Lbs.

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provide uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, air, salt water, brine, etc., regardless of temperature.

Write today for YOUR copy!

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

3100 PENNSYLVANIA AVENUE • PITTSBURGH 12, PA.

sion point is high. Instead of carrying hoist to suspension point, roller chain is run out desired length, hoist turned upside down and suspended by chain hook. Load is then attached directly to hoist hook. **Dept P, Whiting Corp, Harvey, Ill.**

Synthetic Resin

ADHESION, FLEXIBILITY AND WETTING POWER make this short-oil-length resin fit for use on iron, brass, bronze, aluminum and highly polished metal. *A*-resin pigmented films air-dry quickly, have good light stability and retain a high and lasting gloss, states the manufacturer. **Dept P, Standard Oil Co (N. J.), 30 Rockefeller Plaza, New York 20, N. Y.**

Temperature Indicators

AVAILABLE IN LIQUID, crayon and pellet form, temperature indicators can be used to check temperatures in many industrial and plant operations. They are for temperatures from 125 to 1700 F. Manufacturer says they are accurate to within 1% of stated temperature. **Dept P, Tempil Corp, 132 W 22nd St, New York 11, N. Y.**

Soldering Flux

NONACID, NONRUNNING, stick-shaped flux provides a quick means of dissolving oxides of metals preparatory to soldering. *Flux-Stik*, it is further claimed, does not spread itself beyond vicinity of application when heated and applies equally well to hot or cold metal. **Dept P, Lake Chemical Co, 607 N Western Ave, Chicago 12, Ill.**

Flexible-Metal Hose

NEW FLEXIBLE-METAL HOSE, ¼ in. in diameter, can be furnished in bronze, steel and various alloys. Hose is suitable for a protective casing on industrial instrument capillary tubes, or as a covering for wire and cable. **Dept P, Pennsylvania Flexible Metallic Tubing Co, Philadelphia, Pennsylvania.**

A broadening of International Nickel's cooperation with universities and colleges in U. S. and Canada, in field of engineering education through distribution of technical literature, was announced. New program will make available useful material for classroom instruction in training students in scientific fields. It has been offered to, and accepted by, a number of important institutions in the U. S. and Canada that give accredited courses in mining, metallurgy, chemical engineering and one or more other engineering courses.

The program will be an activity of development and research div, under direction of Dr W A Mudge, assistant director of technical service on mill products. Prof William B Plank, head of dept of mining and metallurgical engineering, Lafayette College, Easton, Pa., and recently a member of Engineers' Council for Professional Development, will act as consultant.

Make THIS Blue Print FIRST

ASSURE FUEL FLEXIBILITY

Avoid costly errors with any type of COMBUSTION EQUIPMENT

1ST. ECONOMIC ANALYSIS

Make a Fuel Investigation to determine the coals which will be economically available to your plant for at least the next 25 years, considering reserves, production costs, quality and reliability.

2ND. BITUMINOUS COAL SPECIFICATIONS

Make "Bituminous Coal Specifications for Combustion Equipment" your "first blue print." Tabulate on this form the average quality, characteristics and sizes of at least four coals from different producing districts. These coals should constitute the range of coals to be used for generating low cost steam during the life of the plant.

From these average data establish the Combustion Equipment Design Factors, using sufficient tolerances to cover normal variations in quality. It is a costly error to purchase new equipment which is inadequate to burn the range of coals economically available.

3RD. COAL ANALYSIS

Select representative mines in the producing districts shown in the "first blue print," and estimate the probable delivered costs on a B.T.U. basis. For this purpose consider transportation costs, current prices, basic production costs, price trends, and the effect of mine mechanization on future price relationships. Design the plant to use efficiently the coals that have the best competitive future.

FAIRMONT LOW FUSION COAL MEETS EVERY REQUIREMENT FOR LOW COST STEAM GENERATION

. . . it can be burned economically in any equipment properly engineered for its use . . . huge reserves extend the availability of this coal into the far distant future . . . it usually represents "the best value for the fuel dollar" for long range planning. . . . engineering to use FAIRMONT COAL assures the lowest overall steam cost for the life of the plant.

MAIL COUPON

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

1. Return this coupon for a copy of the form "Bituminous Coal Specifications for Combustion Equipment."
2. Place my name on the mailing list for Fairmont Coal Bureau Reference Bulletins. 1. ☐ 2. ☐ (Indicate desires by checking squares.)

NAME..... POSITION.....

COMPANY.....

STREET ADDRESS..... CITY..... Zone..... State.....

P-347

FAIRMONT COAL BUREAU · FAIRMONT REGION · WEST VIRGINIA · SERVICE TO INDUSTRY ·

SPRUCE-UP PAINTED SURFACES

this easy way!

FOR a low-cost, safe way to clean and revive painted surfaces, apply recommended solution of

OAKITE RENOVATOR

Water-mixed, this widely endorsed Oakite material is safe to use. Gentle in action, Renovator does not harm paint, lacquer or synthetic enamel finishes. Thorough detergent action leaves surfaces completely clean. Fully restores bright original lustre. Try it.

FREE DATA

Complete directions are given in Oakite Power Plant Digest. This manual also gives tips for simplifying all your maintenance-cleaning jobs. Send for your FREE copy TODAY!

OAKITE PRODUCTS, INC.
23 Thames Street, NEW YORK 6, N. Y.
Technical Representatives in Principal Cities of U.S. & Canada

OAKITE

Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

Power News

(*Continued from page* 144)

American Society of Mechanical Engineers is sponsoring the luncheon on the opening day of the conference as well as the 2:00 session on central station practice. C H Smoot, Republic Flow Meters Co, Chicago, will discuss *Central Station Combustion Control Problems* and William D Halsey, chief engineer, boiler div, Hartford Steam Boiler Inspection and Insurance Co, Hartford, Conn., will present *Inspection for Safety Power Plant Equipment.*

There is also a session on developments in heating at 2:00 pm. H F Randolph, vice-president, International Heater Co, Utica, N. Y., will discuss *Panel Heating with Air.* W S Harris, dept of mechanical engineering, University of Ill., will describe *Baseboard Radiation Developments. Losses in the Cycle of a Heat Pump Using a Ground Coil* will be discussed by R A Budenholzer, Armour Research Foundation of IIT.

DIESEL-POWER REPORTS

At 3:45 pm, diesel-power program will have a report by A G Hoppe, general superintendent, locomotive and car depts, Chicago, Milwaukee, St. Paul and Pacific R R Co, Milwaukee, on *The Performance of the Diesel Locomotive. Diesel Developments of Significance* will be revealed by C G A Rosen, director of research, Caterpillar Tractor Co, Peoria, Ill.

Also at 3:45 pm, H E Smith, distribution planning engineer, Commonwealth Edison Co, Chicago, will explain *Power Supply to Fluctuating Loads on a 4000-Volt Distribution System. Industrial Plant Power Distribution System* will be discussed by C W Wright, electrical engineer, Delco products div, General Motors Corp, Dayton, Ohio.

At 9:00 am, April 1, George L Jorgensen, statistician, Commonwealth Edison Co, Chicago, will speak on *Load Statistics of the Electric Light and Power Industry. Lighting as a Distribution System Load* will be discussed by O A Hill Jr, Public Service Co of Northern Illinois, Maywood, Ill.

Session on developments in air conditioning will also be at 9:00 am. *Compressors for Air Conditioning* will be explained by A B Newton, chief engineer, Airtemp div, Chrysler Corp, Dayton, Ohio. John Hertzler, vice-president, York Corp, York, Pa., will speak on *Postwar Air Conditioning Advances.*

At 10:30 pm, P L Mercer, plant

MERCURY SWITCHES

are used in all Mercoid Controls. They assure better control performance and longer control life. That is why Mercoid Controls rate a very high percentage of customer satisfaction –a good reason for specifying–

MERCOID CONTROLS

Dust, air, gases and moisture impair the efficiency and shorten the life of exposed electrical contacting surfaces.

Mercoid hermetically sealed mercury switches are immune to all of these switch damaging elements. The contacting surfaces remain constant in their efficiency, prolonging the life indefinitely.

Mercury switches bearing the registered trade mark name of "Mercoid" are not subject to open arcing, oxidation, corrosion, pitting or sticking of the contacting surfaces.

Mercoid switches are available to the trade in various designs, sizes and capacities.

There are numerous applications where these switches have a definite advantage over the open contact type switches.

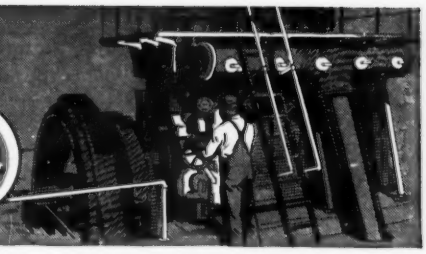
Our engineers gladly offer their assistance in the adaptation of our switches to your switch problems.

THE MERCOID CORPORATION
4201 BELMONT AVE., CHICAGO 41, ILLINOIS

★CONTROLS★
FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

STANDARD ENGINEERS NOTEBOOK

CALOL RPM

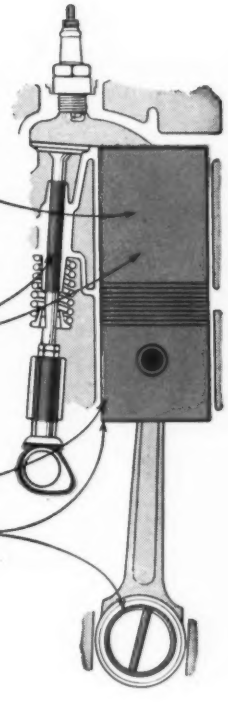


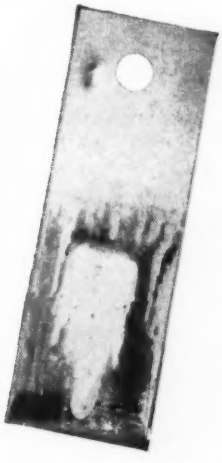
① Adhering agent in RPM Compounded Motor Oil keeps oil film on all parts after engine stops, even on cylinder walls.

② Rustproofing compounds prevent moisture that condenses on cooling parts from contacting metal.

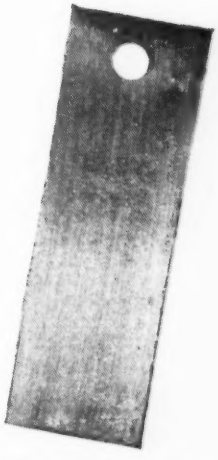
③ No rust is formed to scrape off when engine starts, and cause excessive wear.

④ Constant lubricant film provides adequate and instant lubrication when engine starts.





This actual photograph shows how one HIGH-QUALITY MOTOR OIL "peeled" off almost all of this test strip of steel when it was placed in corrosive-moisture conditions similar to those in a cooling engine. The oil concentrated at one spot and the unprotected surface quickly rusted.



RPM COMPOUNDED MOTOR OIL kept this strip bright and shiny, completely sealed against rusting, when it was exposed to the same conditions. "RPM" compounds keep a constant rust-proofing lubricant film on engine parts at all times, whether they are idle or moving.

How RPM Motor Oil Rust-Proofs As It Lubricates

Rusting, caused by corrosive moisture, is the greatest source of wear in automotive engines (85%, according to some engineers). It can be controlled by using RPM Compounded Motor Oil.

Additional compounding for "RPM," perfected by Standard of California scientists, provides a rust-proofing lubricant film on internal engine surfaces. The heaviest moisture condensation in idle or cold-running engines will not cut through it.

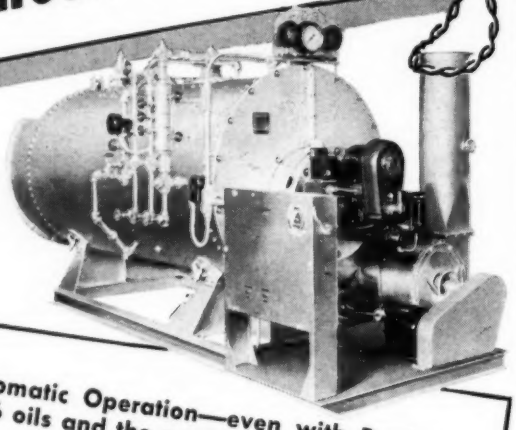
Other compounds in RPM Motor Oil give it adherent qualities so the film stays on parts at all times. They also loosen and remove gum and lacquer, lubricate hot spots, resist sludge formation, bearing corrosion and stop foaming.

Trademark "RPM" Reg. U. S. Pat. Off.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Colo.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT

The Only Packaged STEAM GENERATOR with all these features



1. Fully Automatic Operation—even with Bunker C or No. 6 oils and the new catalytic residuals.
2. Pull-Through Draft—eliminates the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.
3. More Than 80% Thermal Efficiency—proved and guaranteed.
4. Low Maintenance—due to 26 years of combustion experience.
5. Full Range of Sizes—available in sizes from 20-500 B.H.P. and pressures up to 200 lbs.

For complete engineering data and detailed specifications of the Preferred Unit Steam Generator, mail the coupon below. Your copy of Bulletin 1000 will be sent by return mail.

In addition you will receive a copy of the well-known booklet, "Dividends From Your Power Plant"—36 pages of valuable information which you can use to sell your importance to management.

PR-146

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY NEW YORK 23, NEW YORK

Please send me FREE and without obligation, bulletin #1000 and the ten articles in booklet form, titled—"Dividends From Your Power Plant".

Name.....

Company Name.....

P-3-47 **Street**.....

City..... **State**.....

PREFERRED UTILITIES

manager, Union Electric Power Co, Keokuk, Iowa, will speak on *Keokuk Hydro—A Third of a Century Old. Coordination of Hydro and Steam Power in the Missouri Basin* will be presented by E Robert de Luccia, chief, Bureau of Power, Federal Power Commission, Washington, D. C.

Energy Sources of Tomorrow and *Methods of Firing Pulverized Coal* will be the topics under fuels and combustion program at 10:30 am. Ralph A Sherman, supervisor, fuels div, Battelle Memorial Institute, will discuss the former, and Otto de Lorenzi, director of education, Combustion Engrg Co, New York, will present the latter, with aid of colored motion pictures.

Speaker of the joint luncheon at 12:15 pm with American Institute of Electrical Engineers will be W C Johnson, vice-president, Allis-Chalmers Mfg Co, Milwaukee.

Power cables, topic of the 2:00 pm session, will be discussed from the standpoint of *Aerial Cables for Electric Distribution* and *Corrosion of Underground Cable Sheaths Due to Local Cells.* George H. Landis, electrical distribution manager, Central Hudson Gas & Electric Corp, Poughkeepsie, N. Y., will present the first topic and L F Greve, Commonwealth Edison Co, Chicago, will discuss corrosion.

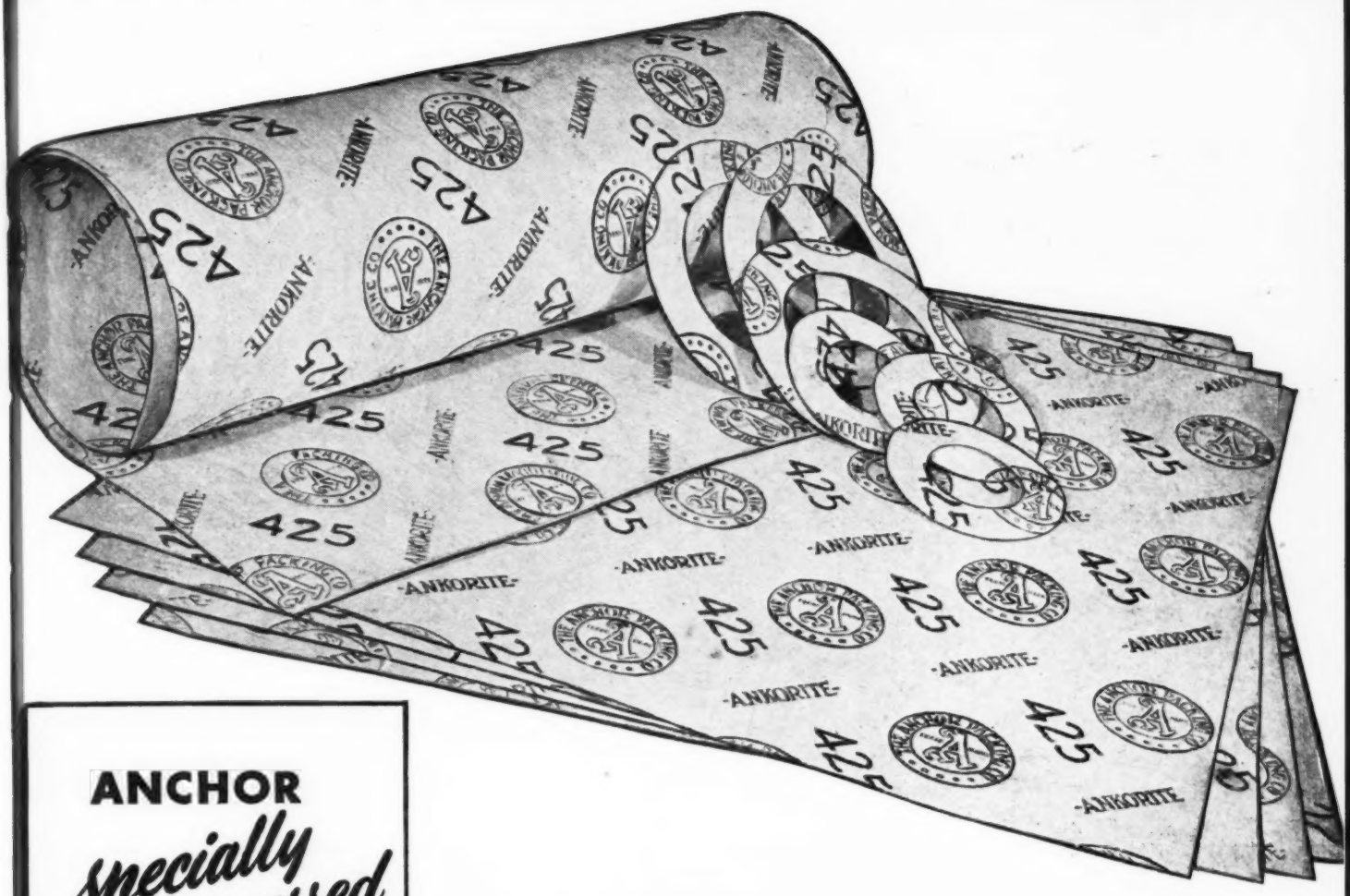
SMALL POWER-PLANT REPORTS

At 2:00 pm session on small power plants, Robert Krause, assistant plant manager, Container Corp of America, Chicago, will discuss *Power for the Paper Industry* and problems *of Reduction of Air Pollution From Small Boiler Plants* will be described by Parker A Moe of Gates, Moe & Weiss, Engineers, Milwaukee.

First session of electronics in industry, at 3:30 pm, will introduce John M Cage, manager, industrial electronics div, Raytheon Mfg Co, Waltham, Mass., who will speak on *Good and Bad Electronic Heating Applications in the Wood Industry. Latest Developments in Electronic Control* will be explained by W D Cockrell, industrial engrg div, General Electric Co, Schenectady.

The "All Engineers" dinner, to be held at 6:45 pm, will be an informal gathering with Richard D Deupree, executive chairman, Army and Navy Munitions Board, Washington, D. C., and president, Proctor & Gamble Co, Cincinnati as the principal speaker.

Session on metallurgy of power plants will be at 9:00 am, April 2. J J Kanter, materials research engineer, Crane Co, Chicago, will present *Metallurgical Considerations in H.T.-H.P. Piping Layouts.* Hugh Ross, chief engineer,



ANCHOR *specially processed* ASBESTOS SHEET

. . . WITHSTANDS HIGH PRESSURES AND TEMPERATURES

A cream colored compressed asbestos sheet manufactured with great care from long fiber Canadian asbestos. Through a special process, a refined mineral pigment with high heat and age resisting qualities is combined with the asbestos fiber and "felted" into laminated form under heavy pressure, to produce the finished sheet. This sheet is homogeneous and may be depended upon for high pressures and temperatures.

Sizes from 1/64" to 1/8" in sheets 50" x 50", 50" x 150", 60" x 60", 75" x 150", 150" x 150" or multipies thereof.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

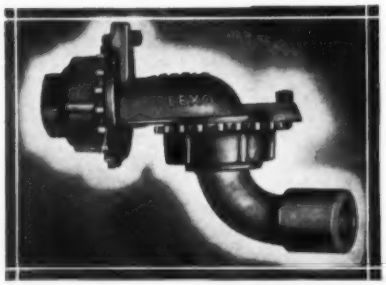
BRANCH OFFICES

Baltimore 2, Maryland	106 Stewart Bldg., Gay and Lombard Streets
Boston 14, Massachusetts	303-04 North Station Building 150 Causeway Street
Buffalo 2, New York	Andrews Building
Cleveland 13, Ohio	523-25-27 Rockefeller Building
Columbus 9, Ohio	172 North Cassingham Road
Chicago 11, Illinois	230 East Ohio Street
Cincinnati 2, Ohio	4 West 7th Street
Detroit 26, Michigan	169 West Jefferson Avenue
Houston 2, Texas	509 Washington Avenue
Kansas City 6, Missouri	1332 Oak Street
Los Angeles 21, California	720 Mateo Street
Montreal 20, Canada	5575 Cote Saint Paul Road
Milwaukee 2, Wisconsin	903 East Kilbourn Avenue
New Orleans 4, Louisiana	418 Common Street
New York 13, New York	100 Sixth Avenue, near Canal
Philadelphia 8, Pennsylvania	401 North Broad Street
Pittsburgh 22, Pennsylvania	405 Penn Avenue
Portland 1, Oregon	1433 S. W. Front Avenue
San Francisco 7, California	156 South Park
Seattle 4, Washington	2207 First Avenue, South
St. Louis 3, Missouri	1407 Pine Street
Tulsa 4, Oklahoma	823 South Gary Place
Wilmington, California	524 North Avalon Boulevard

for SAFETY and SIMPLICITY—

FLEXO JOINTS

The FLEXIBILITY of Hose—
The STRENGTH of Pipe.



Style "H"

The safety of a moving feed line is no greater than the safety of its flexible joints. That's why Flexo Joints are the standard wherever flexible or swing joints are required for steam, air, gas, water, oil or other fluids. Swivel through full 360° with no flow restrictions.

4 SIMPLE PARTS

Style "A"

Style "B"

Style "H"

No small parts, no springs, no ground surfaces to wear. Fully enclosed from grit and dirt. In four styles—standard pipe sizes from ¼" to 3".

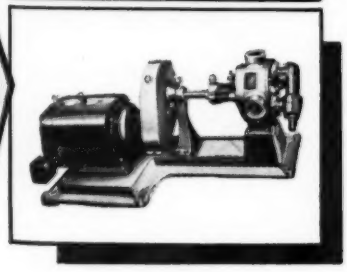
WRITE FOR DETAILS AND SPECIFICATIONS.

FLEXO SUPPLY COMPANY Inc., 4224 OLIVE ST. St. Louis (8).

In Canada: S. A. ARMSTRONG 115 Dupont St., Toronto (5), Ontario

You Are Looking at the ROTARY PUMP Most Folks Look For!

VIKING



And there's a reason . . .

It does the job because it is simple . . . just 2-moving parts—each self supported. It operates at low speed resulting in longer, trouble-free life. There are no gadgets, springs, timing gears etc. to get out of order.

It's self-priming . . . moves the liquid without pulsation. Delivers against discharge pressures of 50-100-200-500 psi depending upon the application and construction.

Write today for folder 46SW.

See Our Catalog In SWEETS

VIKING PUMP COMPANY
CEDAR FALLS, IOWA

centrifugal pump dept, Allis-Chalmers Mfg Co, Milwaukee, will discuss *Materials as a Consideration in Modern Boiler Feed-Pump Construction.*

Second session on electronics in industry is also at 9:00 am. C H Barnard, application engineer, Bailey Meter Co, Cleveland, will present *Electronics in Power and Process Instrumentation and Control.* R C Cheek, central station div, Westinghouse Electric Corp, E Pittsburgh, will describe *Power Line Carrier Current Equipment.*

At 10:30 am will be held the second session on hydro power. *Correlation of Hydro-Plant and Steam-Plant Operation* will be discussed by Vincent Thieman, Wisconsin Public Service Corp.

Session on feedwater treatment will also be held at 10:30 am. Lyle B Porter, director of research, Illinois Water Treatment Co, Rockford, Ill., will explain *Demineralized Water. Removal of Carbon Dioxide from Alkaline Waters* will be presented by Arthur E Kittredge, vice-president and chief engineer, Cochrane Corp, Philadelphia.

Joint luncheon with Western Society of Engineers will be at 12:15 pm. The speaker will be Preston T Tucker, president, Tucker Corp, Chicago.

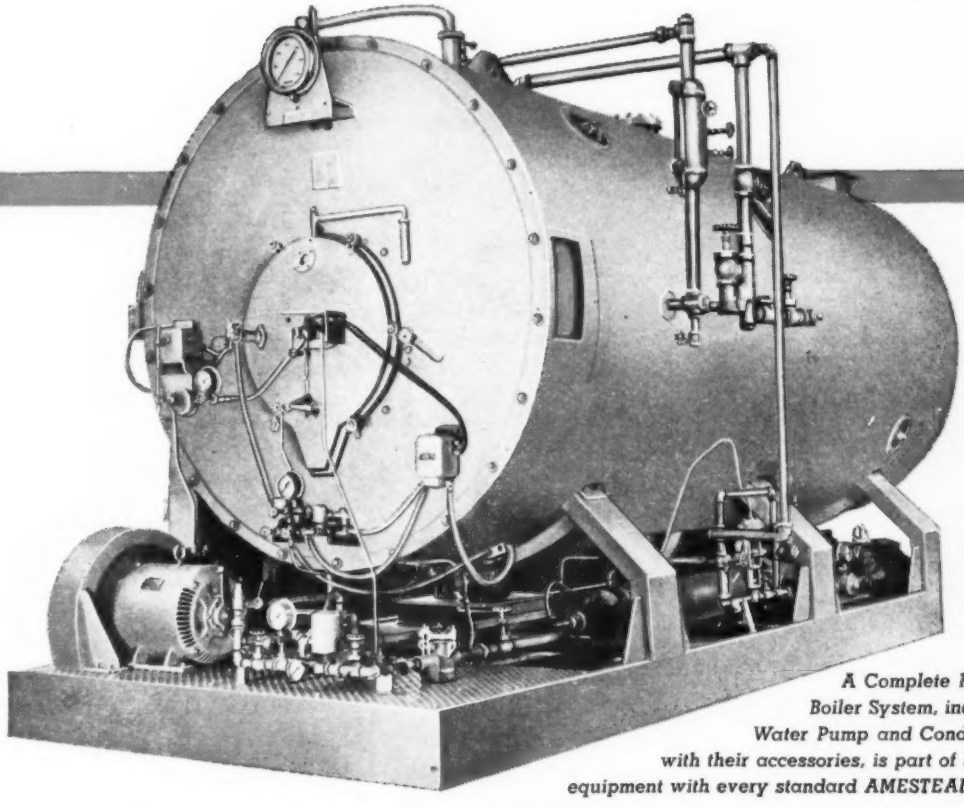
WSE will sponsor the general session on civic duties of the engineer. Mayor Edward J Kelly, Chicago; R M Gates, Air Preheater Corp, New York; and Joseph Lohman, lecturer on sociology, University of Chicago, will lead the open meeting at 2:00 pm.

GAS-TURBINE REPORTS

Session on gas turbines will be at 3:30 pm. *Where Will the Gas Turbine Fit as a Stationary Power Plant?* will be discussed by L N Rowley, managing editor, and B G A Skrotski, associate editor, POWER, New York City. Paul R Sidler, president, Brown-Boveri Corp, New York, will present *Recent Gas Turbine Developments at Brown-Boveri. The Coal-Burning Gas Turbine Power Plant* will be explained by John I Yellott, director of research, Locomotive Development Committee, Baltimore.

At 3:30 pm, R L Witzki, central station engineer, Westinghouse Electric Corp, E Pittsburgh, will speak on *Unit Substations for Distribution Systems* at transmission and distribution session. E W Oesterreich, superintendent of distribution, Duquesne Light Co, Pittsburgh, will discuss *Six-Year Operating Record of Transmission Lines Designed for Improved Performance Under Lightning Conditions. Electric Power—Its Relation to National Security* will be presented by John W Swaren, research analyst, Industrial College of the Armed Forces. Washington, D. C.

where POWER means $ $ $



A Complete Return to the Boiler System, including Feed Water Pump and Condensate Tank with their accessories, is part of the standard equipment with every standard AMESTEAM Generator.

AMESTEAM GENERATOR

Maximum power and efficiency plus minimum cost and upkeep means dollars in your pocket. Because the AMESTEAM Generator is rugged and reliable, it gives you service plus.

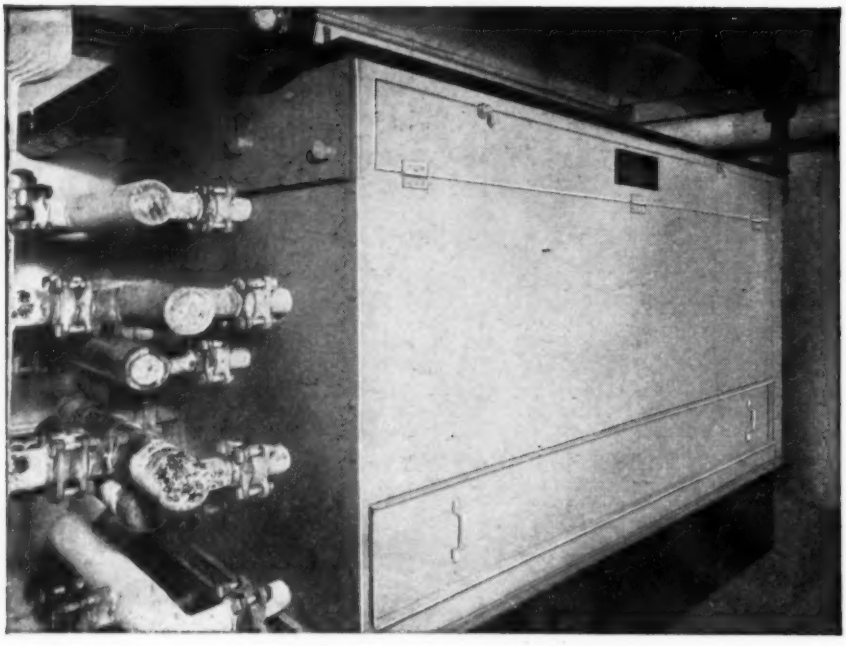
It's compact—installation is quick and simple. It's automatic—handling is easy, operation economical.

100 years of boiler building experience is behind the AMESTEAM design. Assure yourself of low-cost power year after year, by writing or phoning for details today.

Made in standard sizes from 10 to 300 H.P. and standard pressures from 15 to 200 lbs.

AMES IRON WORKS

BOX B3 · OSWEGO, NEW YORK



Chilling Water or Liquids With Accurate Control of Temperature

Regardless of either variation in the cooling load or intermittent operation, the new Niagara Liquid Cooler holds the delivered temperature accurately at the required point. It will deliver fresh water at 33°F. constantly without danger of freezing damage and produces lower temperatures accurately in non-freezing chemical liquids and solution.

Capacity range in available models is from 24 to 465 gallons per minute. High capacity and fast chilling are provided in extremely compact space. The cooler is reliable and easy to maintain; all parts are accessible for cleaning; insulation is easily applied; operation is economical of power and refrigeration.

Write for Bulletin No. 100-P

NIAGARA BLOWER COMPANY

Over 30 Years' Experience in Industrial Air Engineering

405 Lexington Ave. NEW YORK 17, N. Y.

Field Engineering Offices in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Power News

(*Continued from page* 144)

to 40 inches thick and 40 feet wide.

Horizontal, parallel shafts through the long axis of the hill connect at the down-slope end of land section to a cross passage through which air circulates around coal vein. Peepholes, shafted into tunnels at various points, enable engineers to follow the gasification processes.

Air is blown into one shaft from a bulldozed, cutoff trench and from the other shaft mouth in this trench the gases are drawn out. Coal is ignited at the far end of the shafts and burned uphill towards the cutoff.

The Russians have nine gasification experiments under way, several already in commercial use. G O Nusinov, engineer in charge of the Podremgas experiment, listed in a report, printed in the *Canadian Chemistry and Process Industries Magazine*, June 1946, the locations in operation at the beginning of the war.

In addition, Nusinov stated the Russians have employed two techniques in underground gas production (1) feeding common air into the burning area (2) using oxygen-enriched air. The first method produces a gas too heavy in nitrogen content to permit byproduct return; the second gives a gas that can be broken down into gasoline, diesel oil, ammonia, methanol and other synthetics.

But Bureau of Mines experts entered the Alabama project with open minds as far as results are concerned. They are seeking answers to (1) smoothness of gasification underground (2) degree of control over burning (3) efficiency of gas reclamation (4) amount of precipitation in pipelines (5) advantages of oxygen and air feeding (6) byproduct percentage.

Heating Branch of Air Installations Section, Tactical Air Command, Langley Field, Va., has a vacancy for a heating engineer. Position is under Civil Service, carries a $4902 to $6862.80 yearly salary. Applicant should preferably be an engineering graduate with broad experience in all phases of heating engineering. Work involves technical supervision of design, construction and maintenance of individual and central-heating plants at Tactical Air Command stations. Occasional travel is involved for which a per diem allowance of $6 per day is authorized. Applicants submit a Civil Service Form No. 57, secured from any post office or Civil Service representative.

USE THESE BETTER

Vogt Products

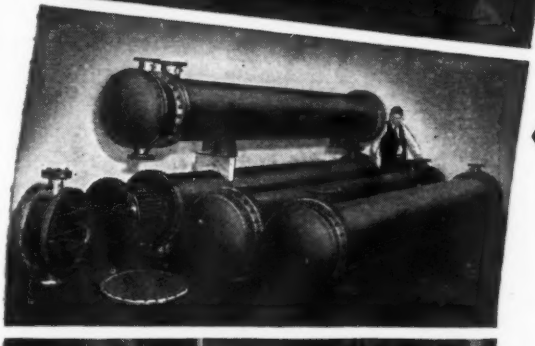
For Today's Tough Service Demands

EFFICIENT AND DEPENDABLE STEAM GENERATION

Vogt steam generating units are designed to give maximum rating in a minimum of space with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels, as desired, meet every power, heating or process requirement.

PROCESS EQUIPMENT FOR EVERY SERVICE

Stills, towers, oil chilling machines, filter presses, heat exchangers, etc. are constructed to all Codes. They meet all demands for operating security and trouble-free performance and help to lower costs in important process industries around the world.

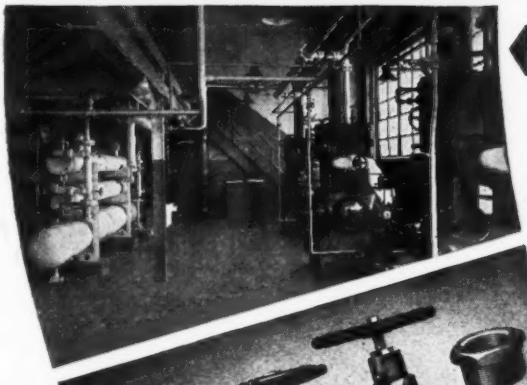


SPECIAL MATERIALS FIGHT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment made from special metals and alloys to combat corrosion, and product contamination or discoloration. Fabrication procedures employed insure that corrosion resistant properties of welds will match that of the materials from which units are constructed.

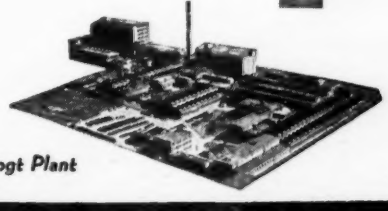
MORE TONNAGE AT LESS COST

Over 60 years of manufacturing experience, engineering and research stand behind Vogt refrigerating and ice making machinery. Absorption Systems, Compression Systems, and the Automatic Tube-Ice Machine in a wide range of capacities serve in leading petroleum refineries, chemical plants, ice and cold storage plants, dairies, packing plants, etc., at home and abroad.



DROP FORGED FOR EXTRA TOUGHNESS AND LONG-TIME SERVICE

Vogt valves, fittings and flanges, for top performance in oil, water, air, gas, and ammonia services, at high or low pressures and temperatures, are available drop forged entirely from carbon steel or stainless steel. Valves can be furnished in a combination of materials by using stainless steel for parts affected by service temperature or corrosion, and less expensive alloys or carbon steel for other parts.



Air View of Vogt Plant

HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS

LEARN THE SECRET OF BIG EARNINGS IN

COMBUSTION ENGINEERING

There are plenty of big jobs today in Combustion Engineering. Such jobs have always been big pay jobs —and today they are better than ever. High fuel and equipment costs means a greater demand for combustion trained men than ever before.

Do you want such a job? You can have it—if you will train for it. And that is *easy to do.* Just a little of your spare time is required for the simple, easy-reading, practical Hays Home Study Course in Fuel and Combustion engineering.

A few of our friends whose employees have advanced through Hays training:

- International Harvester Co.
- Armour & Co.
- Combustion Engineering Co.
- Riley Stoker Corp.
- Iron Fireman Mfg. Co.
- Commonwealth Edinson Co.
- State of Illinois Cities Service (Oil & Power)

and many others.

For 28 years we have specialized exclusively in such training. Today, Hays trained men are more in demand than ever. Now is the time to do what hundreds of others have done who hold substantial positions of responsibility today.

Write for Free Book Now!
Don't Delay! Mail Coupon Today!

You can't lose by getting the facts. We'll send our book, "Opportunities for the Combustion Expert" without obligation or expense to you. Learn how every lesson is administered by trained practical staff men who give the utmost in help and guidance. Get complete outline of course. Learn how to become a key man in Combustion. Send in the coupon now!

Hays Institute of Combustion
430 N. Michigan Ave., Chicago 11, Ill.
Dept. 13
Our 28th Consecutive Year

HAYS INSTITUTE OF COMBUSTION
430 N. Michigan Ave., Chicago 11, Ill.
Dept. 13

Please send me your Free Book "Opportunities for the Combustion Expert" —No obligation.

Name .....
Address .....
City ..... State .....
Company Name .....

Of Oil & Gas Power Div

The 19th Annual Conference of Oil & Gas Power Div of American Society of Mechanical Engineers is scheduled for Cleveland on May 21-24. Hotel Statler, in that city, will serve as conference headquarters. Registration will take place the morning of opening day, Wed, May 21. Thereafter technical sessions are planned on following subjects: fuel supplies for internal-combustion prime movers (liquids, commercial gases, byproduct gases); bearings (types, features, performance); European developments in internal-combustion machinery; combustion fundamentals.

Ample time is to be allowed for plant inspection trips. Social aspects of the conference center about May 22 dinner, social hours and an evening get-together.

Manufacturers' exhibits will play a prominent part. J M Clark has been appointed exhibit secretary.

Pending announcement of final details, it is urged that those planning to attend the conference make room reservations with Hotel Statler prior to May 1.

George Codrington, prominent Cleveland industrialist and manager of Cleveland diesel div of General Motors, is honorary chairman. Heading the over-all committee on arrangements is Lee Schneitter, O & GP chairman. L N Rowley Jr is chairman of meetings and papers committee, and C F Foell, div secretary, is in charge of publicity. Locally, the committee is being assisted by P B Jackson, an associate of the div's executive committee, and Edward Crankshaw, chairman of Cleveland section of the ASME.

Atomic Power Plant Forecast for Jamestown

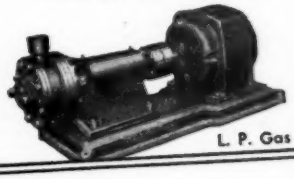
With an eye peeled to the atomic future, Jamestown, N. Y., a pioneer in municipally owned public utilities, has ordered its engineers to probe cost of scrapping its present $4,000,000 power plant in favor of a new and larger one. The order came from Clyne Crawford, chairman of board of public utilities, after a meeting in which Melvin O Swanson warned against ignoring possibilities of atomic energy.

Swanson, who said he could not discuss detail of atomic power for security reasons, had urged the board to make sure a power-plant site "would be large enough for the later construction of an atomic power plant to replace coal as a source of energy." He said plants of 20,000-kw capacity to be powered by atomic energy were already being considered.

Crawford said Swanson's testimony had not "entirely" influenced the board's decision, but added that a new plant was considered because it would "have plenty of spare space which might be utilized for the adaptation of atomic energy."

Jamestown's present plant, built in 1891, has a rated firm capacity of 23,500 kw. Increased demands upon its production have brought about a $4,000,000 expansion program in which it is hoped to boost the capacity to about 40,000 kw.

PEERLESS
CENTRIFUGAL PUMPS
(Formerly Dayton-Dowd)
Use This Handy Guide to Help You Select the Pump Your Service Requires


L. P. Gas Pump

PEERLESS PUMPS Listed below are but a few pumps in the complete line of Peerless Centrifugal Pumps. Bulletins available.

PUMP	G.P.M.	HEAD OR PRESS.

TYPE "A" TO 60,000 UP TO 300 FT.

Applications: Designed for general service water pumping in a variety of industries. Embodies advanced construction for high-efficiency, low-cost operation.

TYPE "B" TO 1,000 UP TO 700 LBS.

Applications: Designed particularly for medium capacity, high pressure boiler feed, oil refinery and pipe line service. Multi-stage, split case construction.

TYPE "AF" TO 2,000 UP TO 125 LBS.

Applications: Peerless Fire Pumps (formerly Dayton-Dowd) are the foremost in fire pumps. Embodying latest developments, their selection assures low cost, modern plant fire protection. Underwriter's approved.

TYPE "CO" TO 1,000 UP TO 200 LBS.

Applications: Especially developed for chemical, refinery, paper mill, food and process industries. Designed to handle acids, black liquors, hot oil, caustics, etc.

PEERLESS PUMP DIVISION
Food Machinery Corporation
Factories:
Canton 6, Ohio Quincy, Ill.
Los Angeles 31, Calif.
District Offices:
Canton 2, Ohio; Ardmore, Pa.; Decatur, Ga.; Dallas 1, Texas
Distributors in Principal Cities

in expansion joints

there is only one BADGER

• E. B. Badger & Sons Co. is the original and sole manufacturer of BADGER Expansion Joints

BADGER Self-equalizing Corrugated Expansion Joints should be a "must" on all pipe-line installations.

Because only in *Badger* Expansion Joints are the flexing movement and stresses definitely directed so that:

All points of the surface of each corrugation share its individual load equally, and

All the corrugations share the stress load equally.

With Badger ALL-CURVE Directed Flexing Rings and Badger ALL-CURVE corrugations, excessive stresses can't localize in pockets, corners or junctions, nor pile up unevenly among the corrugations. They can't endanger the line or shorten the life of these superbly engineered joints.

Special Badger methods of forming the corrugations from a single piece of tubing contribute further to the strength of these joints, and a special Badger heat treatment preserves their flexing qualities.

Each corrugation affords a definite standard of traverse, according to its depth and the diameter of the joint. This makes it easy to determine the number of corrugations required to absorb the maximum expansion of any length of line.

When you install dependable, long-lasting Badger Self-equalizing Corrugated Expansion Joints, your pipe-expansion problems are solved.

MADE IN COPPER, STAINLESS STEEL AND OTHER ALLOYS — Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements—and where corrosion is a prob'em. Single or multiple corrugations—for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. Send for Bulletin No. 100 (*Self-equalizing*) or No. 200 (*Non-equalizing*).

Badger

E. B. BADGER & SONS CO., 75 Pitts Street, Boston 14, Mass.

AGENTS IN PRINCIPAL CITIES

PACKLESS CORRUGATED EXPANSION JOINTS

DISGUSTED WITH DUST?

Bottle it up with S.E. Co. Dust-tight Coal Scales!

Are your coal scales of the "Model T" variety . . . loose at joints and doors, allowing coal dust to seep and sift through your plant? You can eliminate this costly, aggravating condition by installing S. E. Co. Coal Scales. They're *dust-tight*—constructed with smoothly welded seams and completely sealed doors to keep dust where it belongs—inside!

TRIED THE S. E. CO. "BOTTLE TEST" YET?

1. Partly fill any small bottle with dry coal.
2. Cork the bottle tightly and shake it.
3. Brother, the dust you see in that bottle is just a small part of the amount that could sift into your plant with non-dust-tight equipment.

Write for full details on S. E. Co. Dust-tight Coal Scales, Coal Valves and CONICAL Distributors. Address The Stock Engineering Company, 715 Hanna Building, Cleveland 15, Ohio

STOCK ENGINEERING CO.

★ CONICAL Non-Segregating Coal Distributors ★ S.E.CO. Coal Valves and Coal Scales

APPOINTMENTS

Allis-Chalmers Mfg Co, general machinery div, announced a change in its field organization. District offices will be grouped, according to location and similar interests, under direction of regional managers. Each regional manager will have a staff of specialists and regions will operate as self-contained field units. First regional managers are following: W F Taylor, who will supervise New England area; D S Kerr, Southeast area; J L Pratt, Southwest area; and A J Schmitz, Pacific Coast area.

Paul R Pollock has been named manager of Denver, Colo., office of **Allis-Chalmers Mfg Co.** E T Cuddeback is now representing Allis-Chalmers out of the firm's Atlanta, Ga., district office.

Reliance Electric & Engrg Co reelected eight members of present board of directors, and elected Edward E Helm, sales vice-president, a director, to succeed A M MacCutcheon, who recently retired.

Henry M Schmitt becomes chemical industry manager of **Brown Instrument Co,** Philadelphia. O B Pyle has been made industrial manager of Philadelphia branch, and A W Roat industrial manager of St. Louis branch. I K Farley has been placed in charge of major petroleum accounts in Philadelphia area, and Harry D Ruch will also work out of industrial sales div at Philadelphia.

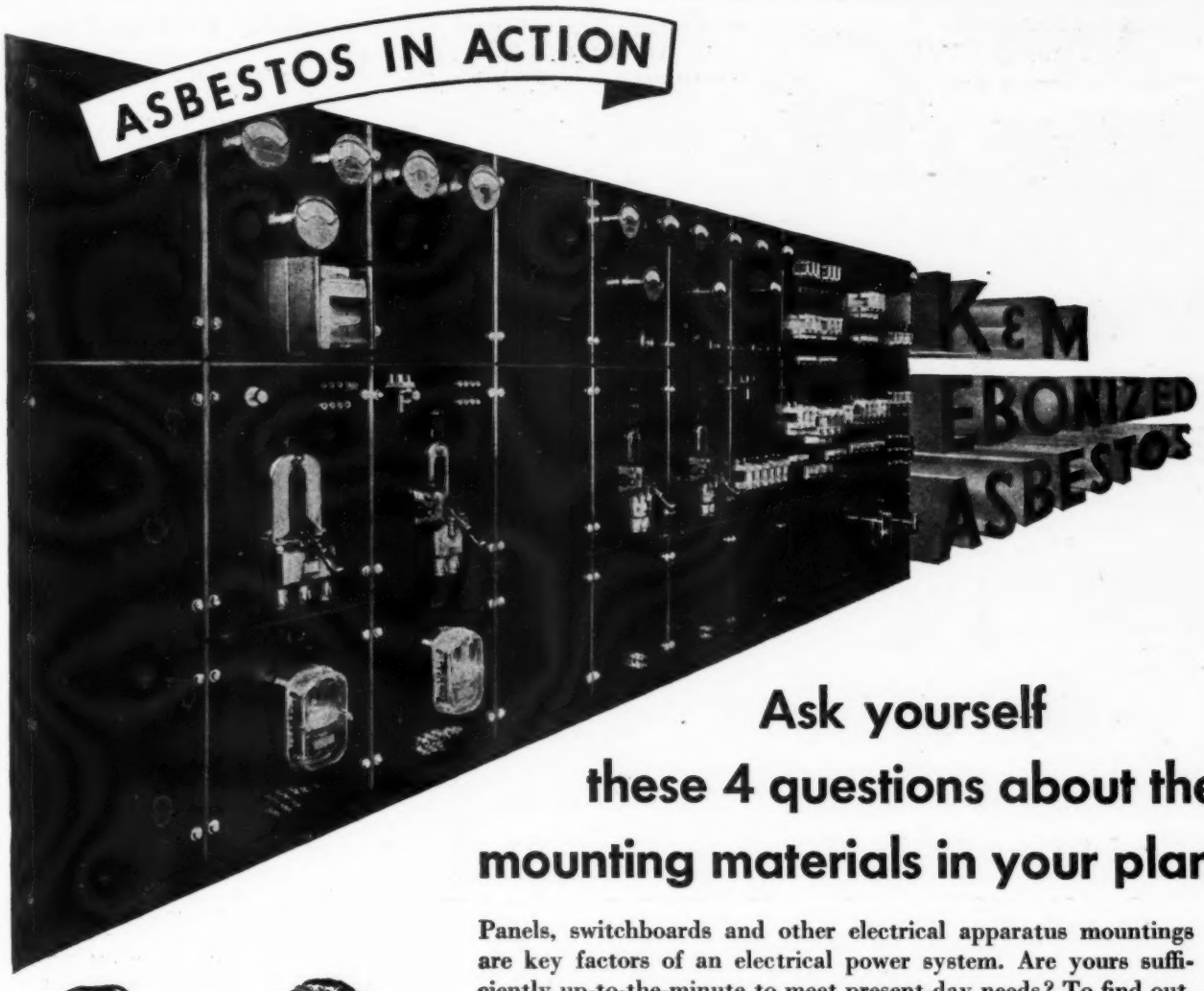
V H Hiermeier has been transferred to international div of **Minneapolis-Honeywell Regulator Co.** He will probably be assigned to a foreign post. Lynn H Johnson has been made sales manager of gas controls div.

Greene, Tweed & Co appoints Howard C Josephson general sales manager.

Donald A MacNeil has joined sales staff of forging div of **Tube Turns, Inc.** He will make his headquarters at 327 S LaSalle St, Chicago.

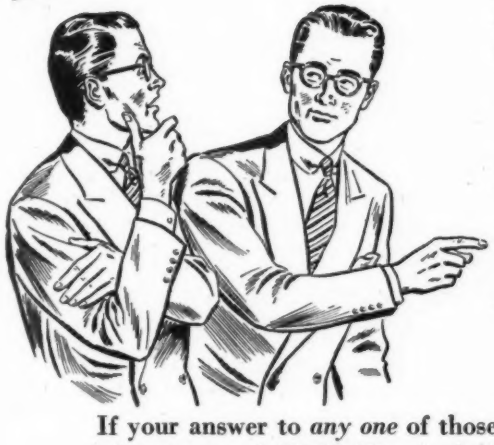
Carborundum Co announces following changes in sales organization of its refractories div: (1) Robert A Barr has been named assistant sales manager. He assumes direct control of div's field sales force, and will eventually make his headquarters at Perth Amboy, N. J. (2) Arthur A Turner was selected as technical assistant sales manager. He will maintain his office at Perth Amboy, N. J. (3) Richard D Rudd will serve as refractories engineer in Chicago territory. (4) D Worth Polhemus has been transferred to Philadelphia district, succeeding J G Fritzinger, who has been appointed district sales manager for abrasive div in Philadelphia district. (5) J H Wisby will take over Cincinnati territory as refractories engineer, with headquarters at Cincinnati branch office.

General Electric Co, has established an affiliated manufacturing companies dept, and appointed Vice-President L R Boulware as general manager. E J Harrington has been named manufacturing manager of



Ask yourself these 4 questions about the mounting materials in your plant

Panels, switchboards and other electrical apparatus mountings are key factors of an electrical power system. Are yours sufficiently up-to-the-minute to meet present-day needs? To find out, ask yourself these four questions:



1. **Are they proof against moisture and oil absorption?**
2. **Can they stand frequent high-voltage surges?**
3. **Will they withstand vibration, or temperature changes?**
4. **Are they in perfect condition — without cracks and unwarped?**

If your answer to *any one* of those questions is "no", it's time to investigate the advantages of K&M Ebonized Asbestos . . . for Ebonized Asbestos is a high-dielectric panelling material that gives a positive "yes" to each of those queries. A tough, all enduring combination of asbestos, cement and an insulating compound, Ebonized Asbestos is ideal for modern electrical work, according to fabricators who work it, and plants that use it. When built into assembled units, it meets the technical requirements of Underwriters' Laboratories, Inc. Write us for full particulars about Ebonized Asbestos.

Nature Made Asbestos . . .

Keasbey & Mattison has been making it serve mankind since 1873

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

THE PACKING for EVERY PURPOSE

Stop Leaks Prevents Scoring

ALLPAX

This universal packing—consisting of long, tough fibrous asbestos fibres, thin flakes of anti-friction metal, minute graphic scales and a heat-proof lubricant — is recommended for general service against steam, water, air, ammonia, oils, gases, etc., where temperatures do not exceed 600°F. Fits all sizes and shapes of stuffing boxes. Special styles available for high temperature and corrosive liquids, for products, etc. Try it and you'll use it regularly.

Distributors everywhere

THE ALLPAX CO., INC., MAMARONECK, N. Y.

Hi-Test KEWANEE

FOR POWER and PROCESS STEAM

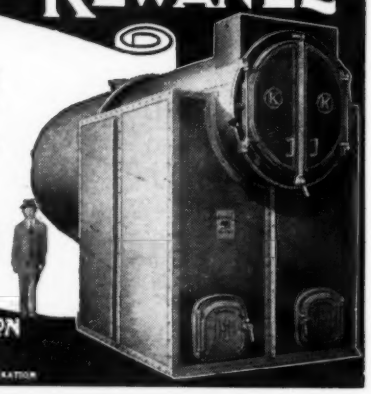
All-welded Portable with refractory lined firebox and fuel-conserving 2-pass tubes. A Q-u-i-c-k Steamer.

6 sizes. 50 to 150 H. P. 125 and 150 pounds W. P.

75 Years Boilermakers

WRITE DEPT. 89-K3 for 6" scale with pipe diameter markings.

WON FOR 5th TIME



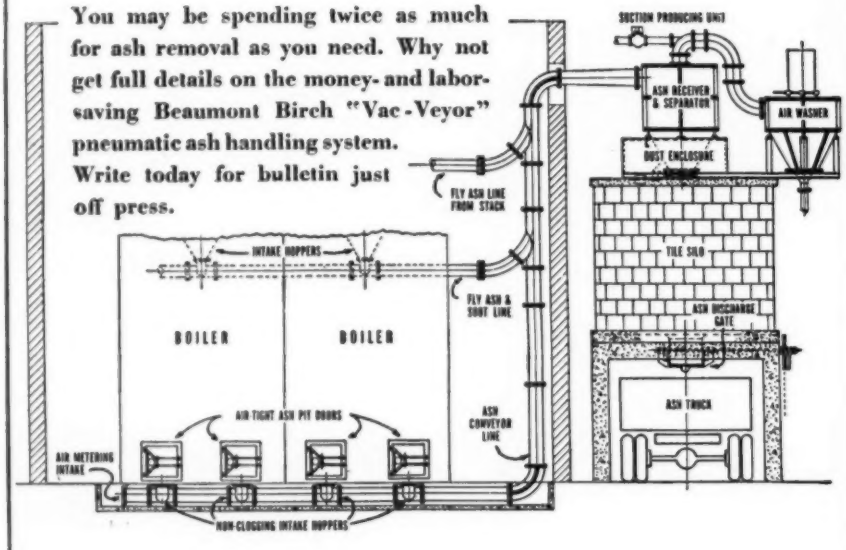
KEWANEE BOILER CORPORATION

KEWANEE, ILLINOIS

Division of American Radiator & Standard Sanitary Corporation

HOW MUCH ARE YOU PAYING TO HANDLE ASHES?

You may be spending twice as much for ash removal as you need. Why not get full details on the money- and labor-saving Beaumont Birch "Vac-Veyor" pneumatic ash handling system. Write today for bulletin just off press.



BEAUMONT BIRCH COMPANY

1502 RACE STREET • PHILADELPHIA, PA.

Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

the new dept and Roy W Johnson marketing manager. The manufacturing affiliates include Carboloy Co, General Electric X-Ray Corp, Hotpoint, Inc, Locke Insulator Corp, Monowatt Electric Corp, Telechron Inc, and Trumbull Electric Mfg Co.

Arthur W Farmer becomes general traffic manager of **General Electric Co.** Farmer replaces Charles E Mochrie, who has retired after having been associated with the company for nearly 35 years. Robert W Larson has been made administrative assistant to director of General Electric research laboratory at Schenectady. In his new position Larson will aid Dr. Suits in planning, and later in operating, the new laboratories being built in nearby Niskayuna.

General Electric chemical dept announced organization changes, establishing plastics div and compound div in place of former plastics divisions. George P Lehmann became manager of plastics div and John L McMurphy manager of compound div. Both men will make their headquarters in Pittsfield. Frank W Warner Jr has been named engineering policy manager of chemical dept, with headquarters in Pittsfield. Arthur G Gustafson has been appointed manager of construction div of chemical dept, with headquarters in Pittsfield.

A W Gilmore has been appointed manager of a new **General Electric** wire and cable div, Bridgeport, Conn. The new div is a consolidation of former York (Pa.) wire and cable div and Bridgeport wire and cable div. Gilmore has named following men to assist him in the new div: M H Owen as manager of York sales section; A E Newman as manager of Bridgeport sales section; C O Hull as engineer; S T Powell as manager of manufacturing; A Hillman as accountant.

Link-Belt Co, Pacific div, Seattle, Wash., is now occupying newly built plant at 3405 6th Ave S, Seattle 4, Wash. Fred A Koepf, district manager, and Harvey V Eastling, manager of engineering sales, with headquarters in Seattle, direct activities of company in this Pacific Northwest area.

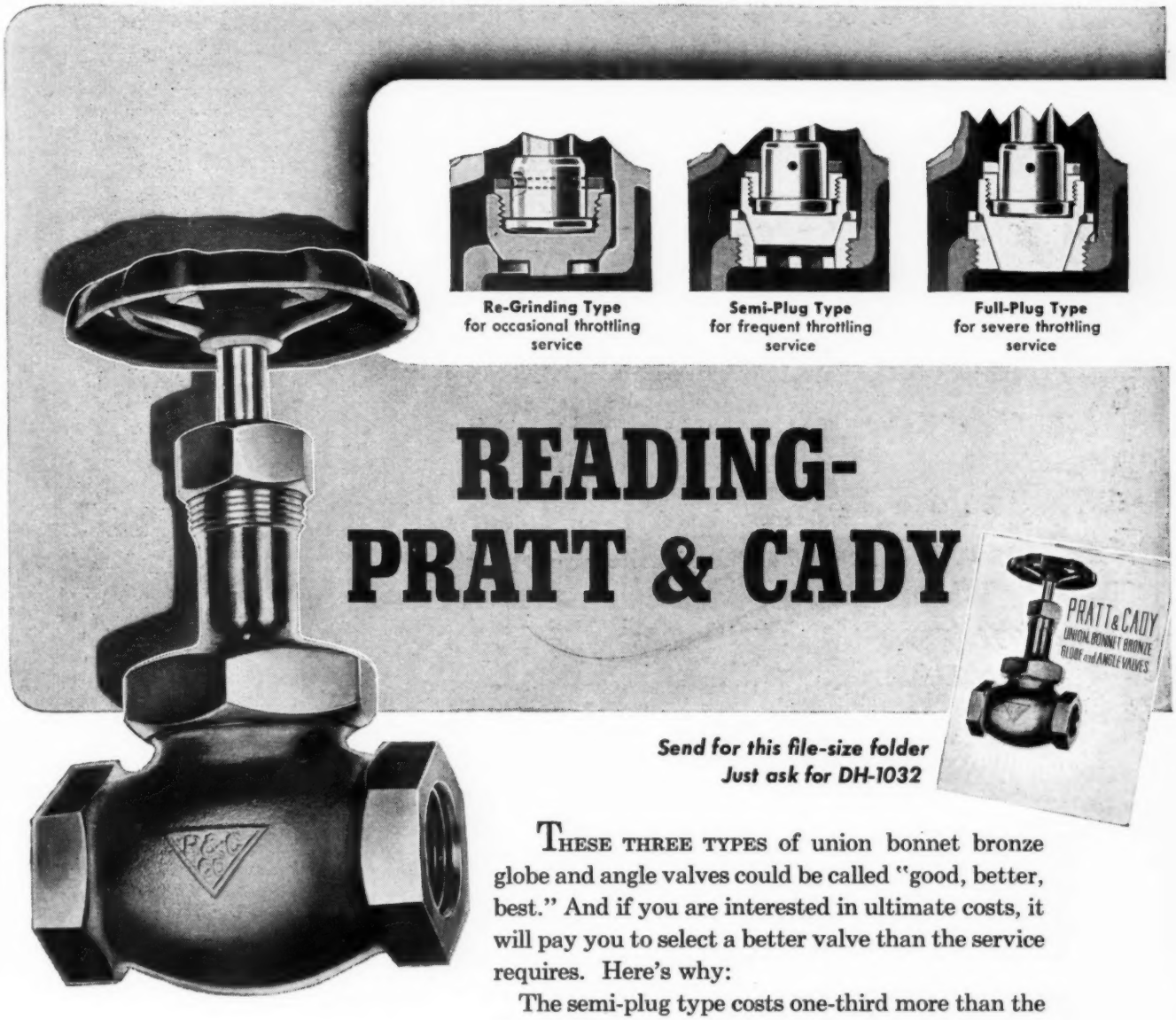
T R Kelley has joined retail div of **Buda Co** as a field engineer and will cover territory embracing northeastern section of U. S. and eastern Canada. Kelley will make his headquarters at Buda Engine & Equipment Co, 1315 Boylston St, Boston, Mass.

Fairbanks, Morse & Co announces appointment of John S King as manager of Chicago branch, succeeding Frank V Roy, who retired from that position on Mar 1.

H E Beane has been appointed general sales manager of **Bristol Co,** Waterbury, Conn.

Lincoln Electric Co announces new addresses of its branch offices in San Francisco, Los Angeles and Birmingham: (1) New location of San Francisco office and warehouse is at 1302 Stanford Av, Emery-

HOW TO GET LONGER SERVICE FROM GLOBE AND ANGLE VALVES



Send for this file-size folder
Just ask for DH-1032

THESE THREE TYPES of union bonnet bronze globe and angle valves could be called "good, better, best." And if you are interested in ultimate costs, it will pay you to select a better valve than the service requires. Here's why:

The semi-plug type costs one-third more than the re-grinding type—lasts four times as long. The full plug type costs two-thirds more than the re-grinding —lasts eight times as long.

These figures are, of course, approximate. But they do serve to illustrate a point. And the point is —get in touch with your Reading-Pratt & Cady distributor for bronze globe and angle valves.

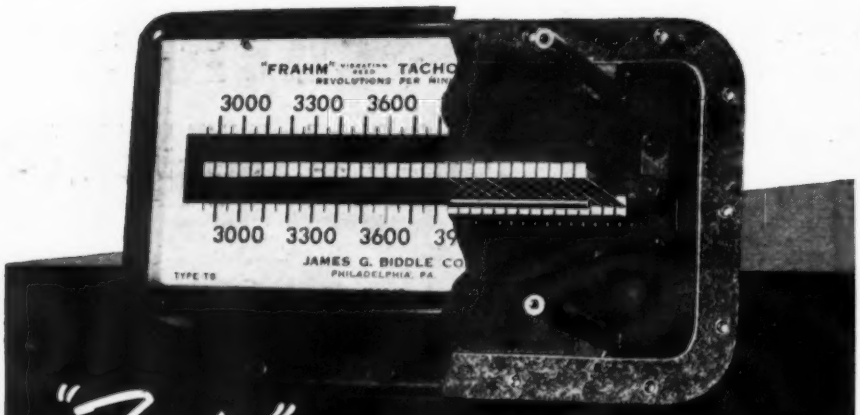
Reading-Pratt & Cady Distributors Are Located in Principal Cities

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • Portland, Ore. • San Francisco • Bridgeport, Conn.

READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK



"Frahm" RESONANT REED TACHOMETERS

Check THESE ADVANTAGES

- **ACCURATE,** because the tuned reed is a natural resonant indicator.
- **DEPENDABLE,** because permanent calibration is a natural characteristic of tuned reeds.
- **STURDY,** because there are no delicate pivots, jewels or moving parts.

and these . . .

EASY-TO-READ vibrating reed-tips form a clearly defined pattern.

LITTLE MAINTENANCE is a result of simple, sturdy construction.

LOW INPUT POWER is sufficient to actuate the reed comb.

OPERATE IN ANY POSITION without affecting accuracy.

ORDINARY ROOM TEMPERATURE VARIATIONS HAVE LITTLE EFFECT on calibration.

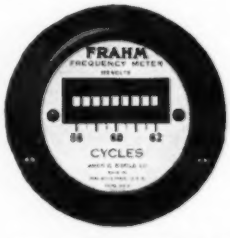
OPERATE WITHOUT DIRECT CONTACT with moving parts under test.

EASY TO OPERATE . . . may be held against or mounted on machine.

Frahm Resonant-Reed Tachometers in round, rectangular and miniature types are available in ranges between the limits of 900 and 100,000 rpm or vpm. Made for permanent mounting on turbines, generators, motors, blowers, centrifugal pumps, diesel-electric installations, etc. Made also in hand types for a wide variety of uses. Write today for Bulletin 1810-P.

"FRAHM" Resonant-Reed FREQUENCY METERS

. . . operate on the same unique principle as Frahm Tachometers except that reed vibration is produced electrically instead of by direct mechanical contact. Available in switchboard, miniature and portable types for ranges between 15 and 500 cycles per second. To meet special requirements, we are equipped to build instruments for measuring frequencies as high as 1400 cps. For complete information write today for Bulletin 1770-P.



James G. BIDDLE CO.

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.

ville 8, Calif., under direction of L P Henderson, district manager and welding engineer. (2) Los Angeles office and warehouse is at 1500 Calzona St, Los Angeles. J B McCormick is district manager and welding engineer. (3) Birmingham district office has its new location at 113 N 9th St, Birmingham, with J E Durstine district manager and welding engineer.

W R Persons has been made sales manager of **Lincoln Electric Co.** He reports to C M Taylor, recently advanced to executive vice-president. Wallner Welding Supply Co has been appointed Lincoln dealer in Duluth, Minn. L D Wallner, general manager of the new company, will be located at 303 S First Av, E Duluth.

Nordberg Mfg Co announces transfer of James H Gallaway, district manager of heavy machinery div, back to his former Midwestern territory with headquarters at Kansas City, Mo. His address is Hyde Park Hotel, 36th and Broadway, Kansas City, Mo. D M Booth has been made regional manager of export div. He will cover Mexico and Central America for Nordberg, with headquarters in Mexico City.

It has been reported that Nordberg has acquired certain manufacturing assets from **Busch-Sulzer Bros-Diesel Engine Co** of St. Louis, and proposes to continue its diesel engine business as a div of Nordberg Mfg Co.

Appointment has been announced of T E Allen to an important executive position with **Thermoid Co** at its Trenton, N. J., headquarters. Allen will serve as assistant to President Schluter on public and industry relations, and will assist the vice-president of automotive sales and service. Also, he will supervise advertising policy and represent the company in industry association meetings. Norris Green has been named acting field manager of Thermoid's oil field products div, replacing Paul Kelting, who died in Dec. Green will have headquarters at 1121 Rothwell St, Houston, Tex.

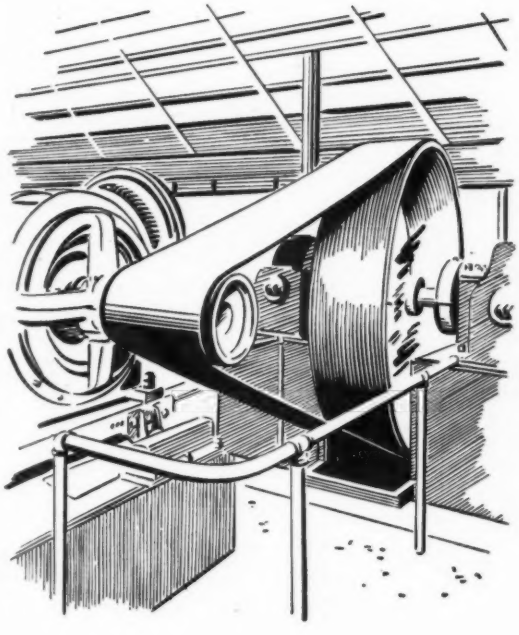
J M Staples, Atlanta official of **Westinghouse Electric Corp,** has been elected Southeastern manager of firm's machinery electrification section.

Kieley & Mueller, Inc, announces appointment of Frabimor Equipment & Controls Co, 5235 North Av, Chicago, as its agents in Chicago and Milwaukee areas. Canadian Charts & Supplies, Ltd, P O Box 754, Oakville, Ontario, Canada, has been made Kieley & Mueller representatives in provinces of Ontario and Quebec.

Rochester Ropes, Inc, announces transfer of Eastern sales headquarters, warehouse and export office to its new building at Water, Jefferson and Cherry St, New York 2, N. Y.

Curtis H Stout, 1808 Beechwood Rd, Little Rock, Ark., has been appointed by **Weston Electrical Instrument Corp** as its sales representative for territory consisting of Ark., western Tenn., northern Miss. and

When you need a trouble-shooter...



Call this man! He's your Industrial Supply Specialist. And he's available to help find the correct answer to your problems.

For example, he knows the kind of transmission belting you need where unusually severe operating conditions exist.

That's why your Industrial Supply Specialist will recommend Monarch Transmission Belting. It's "Job-Engineered" by Hewitt to transmit maximum power under the most critical service requirements.

You see, Monarch is a straight-edge transmission belting made without seams or folds. This construction assures low stretch and longer life, because the load is distributed equally throughout the belt. Monarch actually transmits *more* power because it reduces slippage to an absolute minimum. That gives you lower operating costs, increased efficiency and greater production.

When you need a trouble-shooter, call on your Industrial Supply Specialist. His knowledge, experience, and willingness to be of service will save you time and money.

Specify "Hewitt" . . . Phone the Hewitt distributor listed in the classified section of your telephone directory. Or write to Hewitt Rubber of Buffalo, 240 Kensington Avenue, Buffalo 5, New York.

Monarch Transmission Belting

HEWITT RUBBER
OF BUFFALO
Division of Hewitt-Robins Incorporated

"JOB-ENGINEERED" INDUSTRIAL HOSE • BELTING • PACKING

Chemical
SCALE REMOVAL
requires
ACCURATE DEPENDABLE INSTRUMENTS

. . . and that's why they chose
HENSZEY FLOW INDICATORS

The removal of scale from internal surfaces of boilers, heat exchangers, condensers, piping, and all other mechanical facilities subjected to scale accumulations is now being accomplished by the chemical solvent method in some of America's leading industrial plants.

This highly developed scientific system uses newly designed mobile equipment . . . and HENSZEY FLOW INDICATORS do their share by indicating rates of flow instantly and accurately under all conditions.

This rugged instrument indicates the flow over its entire range — from zero to 100% — indicating a pulsating flow exactly as it occurs. The graduations on the easy-to-read dial are uniformly spaced and read direct — without constants.

If you need accurate information on "how fast it is running"—plan for the installation of Henszey Flow Indicators. Send for bulletin FI-1 for complete details.

HENSZEY CO.
DEPARTMENT D3
WATERTOWN WISCONSIN

HENSZEY
FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

northern La. A R Hough has been named to succeed Arthur L Pollard as its manufacturer's representative, with headquarters at 15 Nokomis Circle, Knoxville, Tenn. Pollard has announced his retirement as a manufacturer's representative.

Weston Electrical Instrument Corp, Newark, N. J., elected John H Miller vice-president and chief engineer. He succeeds W N Goodwin Jr, who, although retired, has been retained as an engineering consultant.

John B Rodgers and Willis A Weld have become vice-presidents of **Fensholt Co,** Chicago.

H J French has been named assistant vice-president of **International Nickel Co of Canada, Ltd.**

Thomas C Wilson, Inc, Long Island City, N. Y., announces appointment of Harang Engrg Co, 840 Lake St, San Francisco, Calif., as its representative in northern Calif. area.

Monsanto Chemical Co appointed Robert B Semple, of St. Louis, as director of its general development dept. Semple will be succeeded as petroleum chemicals sales manager by John Wade Newcombe of petroleum sales dept. William G Krummrich has been named assistant div general manager of organic chemicals div. Krummrich will be succeeded as div production manager by David L Eynon Jr.

Monsanto Chemical Co announces formation of a Texas div, with headquarters at Texas City, and names Joseph R Mares general manager of the new manufacturing unit.

Samuel Insull Jr has been appointed assistant to James S Knowlson, chairman of board and president of **Stewart-Warner Corp.**

A F Heinsohn became general manager of general asbestos and rubber div, **Raybestos-Manhattan, Inc,** N. Charleston, S. C. He succeeded E H Jeffords, who died Dec 12.

Walter L Sturtevant retired recently as chemical engineer at Manhattan rubber div plant, **Raybestos-Manhattan, Inc,** Passaic, N. J.

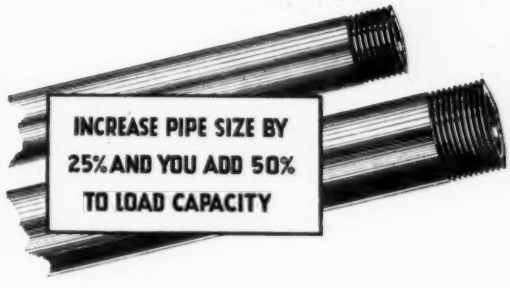
Charles V Carroll has joined engineering staff of **Detroit Stoker Co.** He will make his headquarters at Minneapolis office, 1249 McKnight Bldg.

Parker Applianee Co elected Robert W Cornell a vice-president. Cornell becomes responsible for all manufacturing and related activities of the company in Cleveland. Otto P Bereit was made comptroller and F A Herrington assistant treasurer.

Robert D Bernhard has been appointed by Hewitt rubber div of **Hewitt-Robins, Inc,** to supervise sales of industrial hose

INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS

Ready for this year's 50% load increase.....because "oversize" pipe went in in '44



IT was a forward-looking engineer who specified "oversize" steel pipe a few years ago. If he had been satisfied with sizes barely adequate to do the war-time job, he would now be making major changes to meet a 50% load increase facing him this year.

You can also apply this thought to today's pipe installations,--looking ahead to make sure you are anticipating steam and processing loads of the next five to ten years.

Too many owners and contractors, are content to think only of today. To some it may seem economical to stick to the minimum sizes with which they can "get by." But, of course, it's common sense and long-run economy to plan for future needs as well as present, when you invest in equipment as permanent as steel pipe.

Youngstown Distributors join us in recommending Youngstown Steel Pipe in sizes adequate for tomorrow's needs.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

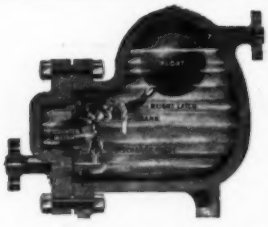
Manufacturers of

CARBON - ALLOY AND YOLOY STEEL

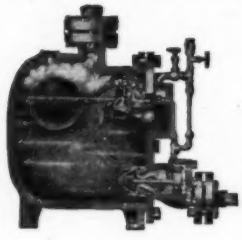
Pipe and Tubular Products-Sheets-Plates-Electrolytic Tin Plate-Coke Tin Plate.

Conduit - Bars - Rods - Wire - Cold Drawn Carbon Steel Rounds-Tie Plates and Spikes.

7 Reasons Why Nicholson Traps REQUIRE MINIMUM MAINTENANCE

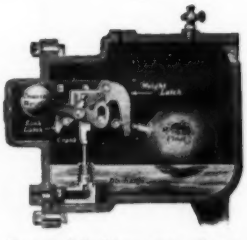


1) Leak-proofed by positive fluid seal over valve.
2) Not dependent on buoyancy or weight of float.
3) Unaffected by re-evaporation of condensate.
4) Non-wire drawing.
5) Rugged, to withstand unavoidable abuse.
6) Not easily affected by dirt, pulsation, etc.
7) Of stainless steel where it counts.



A TRAP FOR EVERY PURPOSE

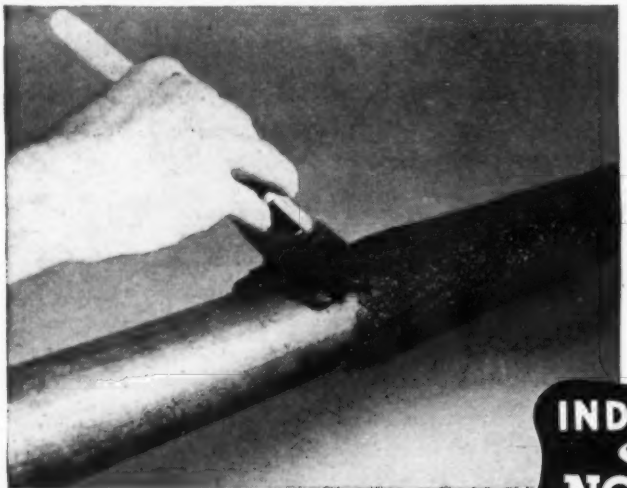
In addition to a complete line of weight and piston-operated traps for steam, air and gasoline, Nicholson also furnishes: expansion traps for steam pressures to 225 lbs.; industrial thermostatic traps for pressures to 225 lbs.; and thermostatic radiator traps for pressures to 25 lbs. Let us send you . . .



CATALOG 444 or SEE SWEET'S

W. H. NICHOLSON & CO.
125 OREGON ST., WILKES-BARRE, PA.

Top and bottom traps shown are weight-operated; middle piston-operated. Pressures to 1500 lbs.



COVER PIPES, TANKS, WALLS, *with* INDUSTRIAL NoDrip

Anyone can brush, trowel or spray NoDrip on any clean, dry surface. Goes on like plaster, forms a seamless, protective coating which effectively ***stops condensation drip.***

NoDrip keeps equipment and floors safe and dry; prevents corrosion of metal and prolongs its life. Acid, alkali and brine resistant. Comes in 1, 5 and 55 gallon drums, ready for use.

TRY NoDrip

Apply NoDrip to a small area, compare the results with uncovered portions.

Send for Free NoDrip Handbook

J. W. MORTELL CO. 549 Burch St., Kankakee, Ill.

and belting in Indianapolis territory, which includes all of southern Ind. and Louisville, Ky. The territory was served formerly from St. Louis office by A S Purmort, who will concentrate his work now in Mo. and southern Ill. territory.

Robins conveyors div, **Hewitt-Robins Inc,** announces changes in its office in Charleston, W. Va. R U Jackson, formerly manager of that office, has been elevated to position of coordinator of mine conveyor sales, thus placing his knowledge of mine mechanization at disposal of all coal-field operators, rather than merely those in Charleston area. Replacing him as manager of W. Va., office is J W Wantling.

Hewitt-Robins, Inc, Buffalo, N. Y., and **McKiernan-Terry Corp,** Harrison, N. J., announce an agreement under which McKiernan-Terry acquires key sales and engineering personnel, goodwill, drawings, jigs, fixtures and spare parts of Robins Conveyors' Mead Morrison div. No change in financial setup or stock ownership of the respective companies is contemplated in connection with new agreement.

R M Hollingshead Corp announces that Dr Gabriel Bosschieter and Clarence D Kirkeby have become associated with new coatings div, which specializes in production of *Cocoon,* the new flexible plastic coating material.

Otis Elevator Co announces appointment of Anthony Pinto as chief engineer.

John P McWilliams was elected to board of directors of **Union Carbide & Carbon Corp.**

United States Air Compressor Co announces entrance of that firm into industrial field through addition of a dept to be known as Bowes coupling and brass div. Sales dept of new div will be headed by C A Bening.

Hayes Mfg Corp, Grand Rapids, Mich., became owner of **American Engrg Co** and its subsidiaries. American Engrg Co retains its corporate identity as it will not be merged with Hayes. Rensselaer W Clark, president, general manager and director of Hayes Mfg Corp for past five years, has been elected president of American. He will retain Grand Rapids as his headquarters. Acting General Manager Edgar Washburn has been elected vice-president and general manager, and J S Bennett has been re-elected vice-president of American. E H Glaettli has been elected controller. He is also controller of Hayes, and will make Grand Rapids his headquarters.

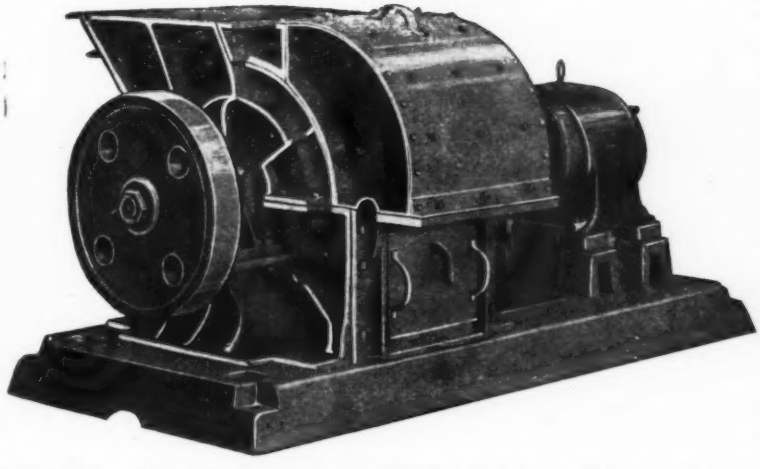
New directors of **American Engrg Co** are following: Rensselaer W Clark, A A Anderson, McKee Robison, Ira A Moore, William B Cudlip, Edgar Washburn and J S Bennett.

Graver Tank & Mfg Co, E Chicago, Ind., and Banks Moreland, Houston, Tex., announce that Banks Moreland's tank business, which was formerly conducted under

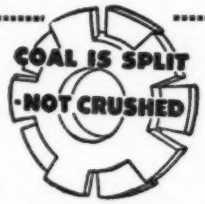
Improved Combustion- Reduced Ash Pit Losses

through low cost uniform coal sizing with

AMERICAN ROLLING RING CRUSHERS



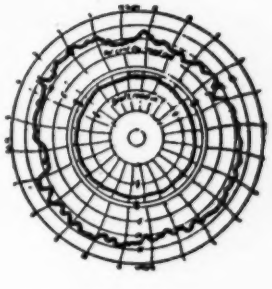
The American Type "S" Crusher is a compact, complete crushing operation for power plants which can be installed in minimum headroom with no auxiliary crushing facilities necessary. Capacities up to 500 TPH.



Only American Rolling Ring Crushers have the patented manganese steel shredder rings that split coal instead of crush it. Revolving freely on individual shafts they deflect without damage from tramp metal, eliminating need for shear pins and other conventional safety devices.

With the increased costs prevalent today, obtaining the maximum BTU yield from every pound of coal becomes more important. To achieve efficient firing—uniform coal reduction is essential. All grades of ROM coal are uniformly reduced to stoker or pulverizer sizes by American Rolling Ring Crushers with minimum fines and no oversize—at a cost of less than 1c. per ton. Uniformly crushed coal results in lowered CO_2 loss and reduced ash pit drop.

Graphically illustrating increased ash pit loss and low combustion efficiency resulting from improperly prepared coal, the CO_2 chart at right emphasizes the need for proper coal sizing such as Americans give.



Send for bulletin: "Crushing Coal for Less Than 1c per Ton"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

Bronze to Bronze

Seated in a True

Makes Dart Unions

•FIT TIGHTER •LAST LONGER

•COST LESS

Because its two bronze seats are precision-ground to form a true ball joint, the Dart Union makes a drop-tight connection without excessive wrenching. It uncouples just as easily—may be used over and over again wherever needed—is thus the least inexpensive in the long run. Made of high-test air-refined malleable iron, it is practically unbreakable. Ask your supplier to demonstrate Dart.

DART
UNIONS

E. M. DART MFG. CO., PROVIDENCE 5, R. I.

name of Banks Moreland Co, was purchased by Graver Tank & Mfg Co and will continue to operate in Southwest as **Banks Moreland Co,** a div of Graver Tank & Mfg Co. New div will be under management of Banks Moreland, who has been made a vice-president of Graver Tank & Mfg Co.

Laurens H Fritz has been named industrial advertising manager of **Sun Oil Co.** He succeeds John C Fairchild, who has resigned.

Burndy Engrg Co has opened a new factory and warehouse in Vernon, Calif. New plant will manufacture many of the connector designs, which are produced also at main factory in New York City. Vernon plant operates under supervision of Lawrence Lyons. He will be assisted by Keith Messent.

After ten years as vice-president in charge of manufacturing and a director of **Revere Copper & Brass Inc,** Rollo E Falk has resigned both of these posts. He will open his own offices at 17 John St, New York, N. Y., where he will specialize as consultant on operating problems in nonferrous metal industry.

Warren Steam Pump Co announces that Parkman A Collins Co has been appointed Warren authorized district agent in territory formerly handled direct from its Boston office. The address remains the same —75 Federal St, Boston.

Elgin Softener Corp announces election of Elwood W Scarritt as assistant general manager. For the present he will continue to act as industrial sales manager in addition to his assistant managerial duties.

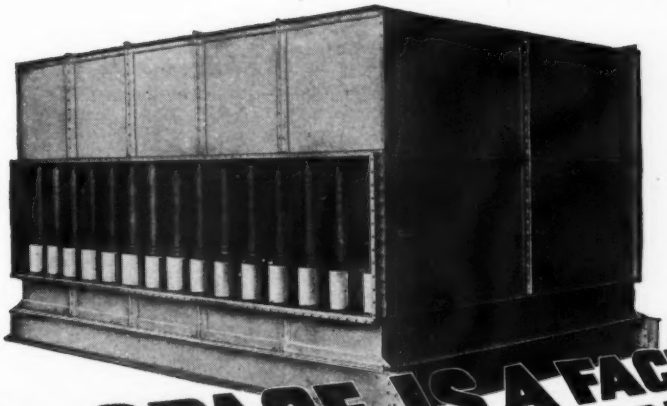
Robert E Hodgson, Georgia district manager of **Standard Oil Co,** of Ky., retired after 47 years of service. He is succeeded by DuPont P Murphey, assistant district manager.

Burns & McDonnell Engrg Co have enlarged their firm membership from four members to eight. The four new members were selected from senior associate engineers and are Arthur F Hartung, Russell G Kincaid, C Kelsey Mathews and Earl J Thomson.

Name of Standard Alcohol Co was changed to **Enjay Co** to provide more efficient service and to simplify operations. Also, new company is taking over products formerly handled by chemical products dept of Stanco Distributors, Inc. Enjay Co is a subsidiary of Standard Oil Co (N. J.). Personnel will be the same.

Worthington Pump & Machinery Corp elected S Riley Williams vice-president in charge of foreign business. He will make his headquarters at Worthington home office in Harrison, N. J.

Dampney Co of America announces appointment of LaVern Warren Marsh to its sales staff. C J Hunter resigns as technical director. Hunter is establishing an engineering sales agency for distribution



WHEN SPACE IS A FACTOR IN DUST COLLECTION

To the many plants faced with meeting severe conditions of local dust ordinances and yet lacking suitable space for a conventional dust collector installation, the following examples of Thermix Tubular installations will provide food for thought:

● In a 125,000 lbs. per hour unit, a Thermix Tubular was installed at the bottom of the tubular air preheater . . . *in the same floor area* . . . using the preheater hoppers for the dust collector.

● A Thermix Tubular Dust Collector was installed *in the bell* of an 8′ diameter stack, handling a 300,000 lb. per hour pulverized fuel boiler.

● In a large paper mill using five pulverized fuel boilers, designs of which did not include provisions for a dust collector, Thermix Tubular Collectors were successfully installed.

These and many others are testimony to the minimum space requirements of Thermix Tubular Dust Collectors, available in extremely compact, easily installed six and nine inch diameter tubes . . . their high efficiency is an established fact.

Write for our suggestions for solving your dust collection problems.

●

THE THERMIX CORPORATION

Project and Sales Engineers

First National Bank Bldg. **Greenwich, Conn.**

PRAT-DANIEL CORPORATION

EAST PORT CHESTER, CONN.

HERCULES
SEAMLESS COPPER
FLOATS
HERCULES

GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degree temperature.

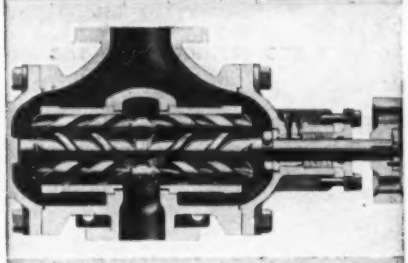
Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure carefree maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

TO KEEP NOISE OUT
-PUT IMO IN



Where quiet, vibration-free pumping is essential, use an IMO...
made for
handling oils and other liquids
at all capacities and pressures
I-127

For further information, write for catalog I-127-P

IMO
I MOVE ON
IMO PUMP DIVISION
of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

of power and mechanical equipment and materials throughout New England area. Dampney plans to assign to its engineering consultants, Arthur D Little, Inc, responsibility for a greatly enlarged research and development program.

D R Berg has become manager of heating and combustion sections of **Dravo Corp's** machinery div.

Graybar Electric Co elected A C Lamperti a director and member of board. He is at 420 Lexington Av, New York, N. Y. Herbert Metz takes over duties of Eastern district manager. His headquarters will be at 180 Varick St, New York, N. Y. He succeeds W J Drury, vice-president and Eastern district manager, who is retiring after over 42 years of service with the company. Metz was appointed a member of executive committee also.

Robert H Bishop and Conda P Boggs were elected vice-presidents of **Sylvania Electric Products Inc.**

C E Scott has joined **Rittling Corp** as vice-president in charge of sales and advertising.

Republic Flow Meters Co announces appointment of Christian W Marks as manager of Cleveland district, which includes northern and eastern Ohio, western New York and Erie, Pa. Office is at 830 Vincent Ave, Cleveland. Eugene N Davidson becomes manager of St. Louis district, which includes eastern half of Mo., southern half of Ill. and western Ky. District office is at 812 Olive St, St. Louis.

W F Boyle has been named vice-president of **Pelton Water Wheel Co.,** a subsidiary of Baldwin Locomotive Works.

Gordon E Medlock has been appointed assistant manager of sales and repairs for **Stearns Magnetic** brake div., Milwaukee 4.

Ladish Drop Forge Co has announced that the corporate name has been changed to **Ladish Co.** No change has been made in organization or policies.

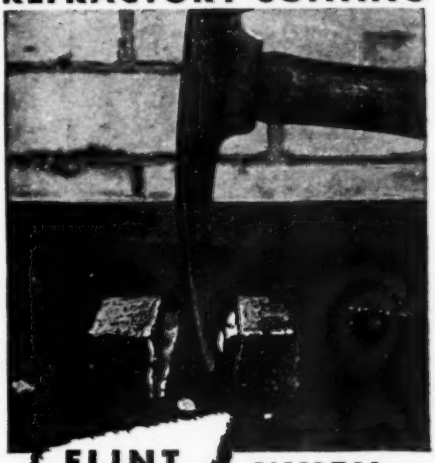
Marley Co announces opening of a Los Angeles office at 408 S Spring St. Arthur C Elias, factory engineer, supervised opening of the branch office during latter part of Jan. The new office will serve greater Los Angeles and all of southern California.

Prof Oscar D Rickly, on staff of Ohio State University's dept of industrial engineering since 1919, has resigned to become general manager of **L H Marshall Co** of Columbus.

William L Hunter has been named general manager of **Northern Equipment Co,** Erie, Pa. Harold A Schlieder succeeds Hunter as chief engineer. Francis W Bunting has been appointed assistant chief engineer.

New appointments and additions to executive sales staff are announced, in line with expansion of various divisions of **Fedders-Quigan Corp:** C W Little is sales mana-

BRICKSEAL
REFRACTORY COATING



FLINT HARD WHEN COLD
Brickseal becomes flint hard as it cools — protects walls from damage.

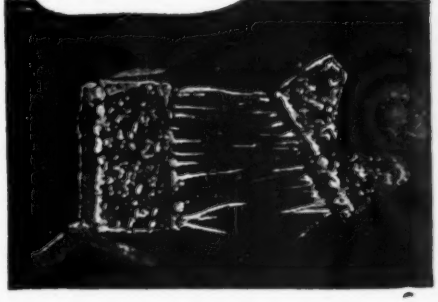
APPLIED LIKE PAINT—Brickseal, a combination of high fusion clays and metal oxides, protects refractories . . . preserves brickwork . . . prevents cracking, spalling and flame abrasion.

When heated, Brickseal deeply penetrates the pores and joints of the bricks and forms a highly glazed ceramic coating for refractory walls.

Brickseal is also used as a bonding material; it produces a tight brick-to-brick joint and welds the wall into one solid unit. Write for illustrated booklet; ask for a demonstration.

Brickseal is semi-plastic when hot allowing it to expand and contract with the furnace

SEMI-PLASTIC WHEN HOT



BRICKSEAL
REFRACTORY COATING
5800 S. Hoover St., Los Angeles, Calif.
1029 Clinton St., Hoboken, N. J.

RIC-WIL CONDUIT MAKES IT POSSIBLE TO INSTALL STEAM LINE UNDER BUSY STREET — WHILE TRAFFIC MOVES AS USUAL

Special flanged prefabricated units 10' 6" long, arranged for lateral expansion, installed in tunnel.

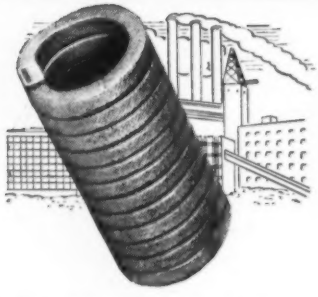
● Ric-wiL prefabricated insulated units enabled the Toledo Edison Co. to carry out a truly modern method of installing underground pipe, without the necessity of tearing up street pavement from curb to curb. Instead of the tremendous expense and crippling confusion which are often involved in such projects, traffic proceeded normally on busy Jefferson St., almost completely unaware of the work in progress below. From a 6 ft. square excavation at the steam main, crews augered 26" x 36" tunnels both ways, welded Ric-wiL pre-sealed units together and jacked them through to building basements. This is a graphic demonstration of one of the many reasons why the words "Ric-wiL Prefabricated Conduit" appear with such constant regularity on engineering specifications sheets.

Write for descriptive Catalog No. 44.

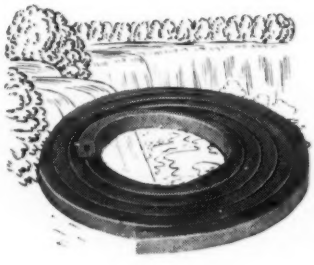
RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY • CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

3 PLACES for a BETTER PACKING

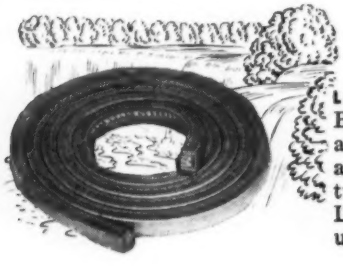
For each of these services Belmont has created a packing with extra construction features that provide more certain sealing and longer life. And for *any* service—steam, water, oil, gas, air, acids, alkalis, ammonia—your Belmont distributor has the *right* packing.



HIGH PRESSURE STEAM RODS — Belmont's No. 30 Asbestos Packing has a unique center construction for greater resiliency and flexibility, extra takeup on the gland as the packing wears, extra "edge wear". The center block is pleated on itself, accordion-fashion, at approx. 90° with the rod.



LOW AND INTERMEDIATE STEAM RODS (also hot and cold water rods and plungers) — Belmont's No. 419 Rubber-and-Duck Packing has a hollow center which provides a point of least resistance for expansion and contraction. Friction is minimum, because the packing "breathes" toward the hole.



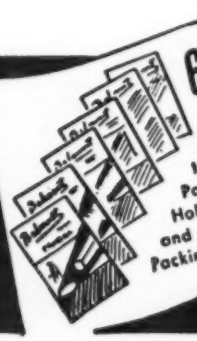
LOW PRESSURE TO HEAVY DUTY WATER — Belmont's No. 9 Special Hydraulic Packing has a rubber-and-duck channel which not only acts as a wiper but also protects the flax—actually two packings in one against the wearing surface. Linen thread stitching prevents displacement under gland pressure.

THERE IS A BELMONT PACKING FOR EVERY SERVICE

Belmont distributors are located in every large industrial center, ready to give you prompt delivery from local stocks.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

IN THE BLUE-AND-ORANGE BOX



6 New Folders

Write us for new folders on Belmont Centrifugal and Rotary Pump Packings, Flax Packings, Hollow Center Packings, Oil and Gasoline Packings, Rod Packings, Sheet Packings.

THE BELMONT PACKING AND RUBBER CO.

Butler and Sepviva Streets
Philadelphia 37, Pa.

ger of heating div. Other Fedder's divisions include radiator div, in charge of A F Ihde; condenser div, in charge of A F DeFino; refrigeration and unit air conditioner divisions, in charge of E A Bonneville; and water cooler div, in charge of H G Williams.

Watson-Stillman Co names C Huizing New England representative.

Arthur B Pike has been appointed Boston area representative by **Farrel-Birmingham Co** to handle sale of gears and gear units manufactured at company's Buffalo, N. Y., plant. He has opened offices at 1736 Massachusetts Ave, Lexington, Mass.

P J Menden has been added to heating, cooling and air-conditioning div of **Young Radiator Co.** He will assist in development and improvement of heating, cooling and air-conditioning products, as well as application engineering for this div. John P Wahlen becomes a sales engineer of heating, cooling and air-conditioning div. Carl H Roath Co becomes distributor for the div in Denver area. Ralph Rayner has been made mechanical engineer in research dept, and will assist in various research problems of heat-transfer products.

Bailey Meter Co is expanding its staff of field engineers: (1) B E Gallagher to Chicago branch office (2) R K Gunsalus to Detroit area (3) H N Thistle to Boston branch office (4) L C Smith to Milwaukee office (5) G W Frey to Halifax branch (6) R L Coghlan to Winnipeg office (7) W R Campbell and E R Mitchell to Montreal (8) W S Fellows, W L Hawks and W L Nungesser are remaining at Cleveland in sales, research and production, respectively.

Appointment of Warren H Hackett and E A Doerschuk as assistant treasurers of **B F Goodrich Co** was announced. H V Gaertner became controller, succeeding T B Tomkinson, who retired after more than 43 years of service.

B J McLaughlin has been appointed district sales manager for Philadelphia territory of Wright mfg div of American Chain & Cable Co, York, Pa. He will make his headquarters at 2nd and Diamond St, Philadelphia.

Herbert S Marks, wartime member of the power "cabinet" of J A Krug in Office of War Utilities and War Production Board, has been appointed general counsel for newly created **Atomic Energy Commission.**

Frank Steixner becomes chief engineer for **Hotel Savoy-Plaza,** New York City.

United Engineers & Constructors Inc of Philadelphia announces election of Edward L Keenan to position of vice-president and purchasing agent.

Arthur D Little, Inc, elected Earl P Stevenson, president; Raymond Stevens and Thorne L Wheeler, vice-presidents; Henry G Powning, treasurer; and Frank N Houghton, secretary. Directors for the

COFFIN TURBO PUMPS

HIGH SPEED . . . SINGLE STAGE

1 STANDARDIZED . . . INDIVIDUALLY ENGINEERED for EACH JOB . . . and AVAILABLE for EARLY DELIVERY

because:

. . . variable speed turbine drive, plus a few frame sizes, plus several sizes of variable internal parts, constitute such an infinite number of possible combinations that the requirements of each application can be met exactly without delay.

Thus:

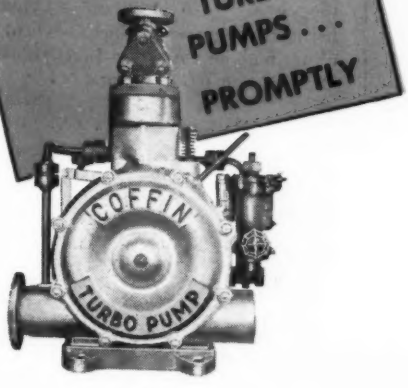
A FEW SIZES OF THESE FRAMES

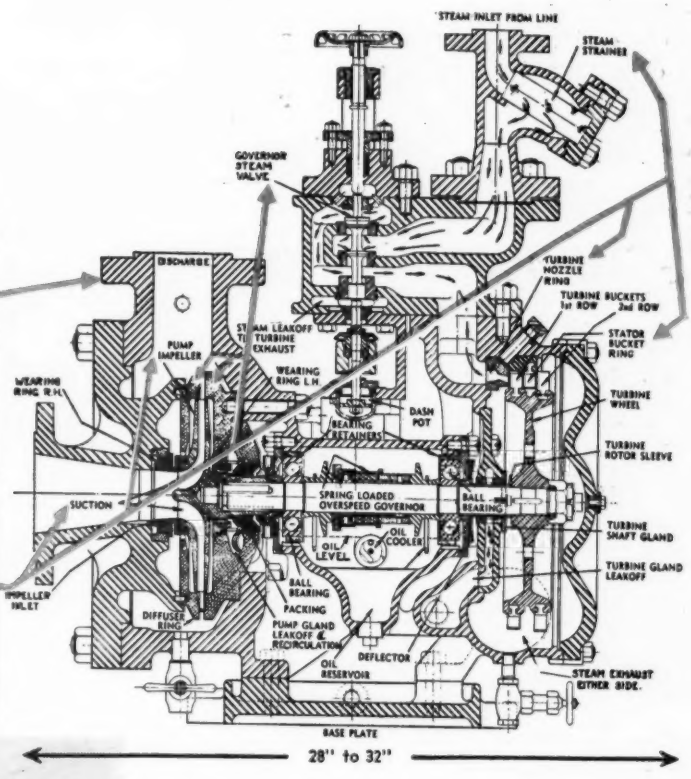
plus:

SEVERAL SIZES OF THESE PARTS

provide:

an endless number of combinations of COFFIN TURBO PUMPS . . . PROMPTLY





Standardized Boiler Feed Units for:

Steam Pressures to 600 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI (Heads to 1800 feet)
Liquid Temperatures to 300 F

UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested . . . for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine results in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

Literature sent on request; specific proposals on receipt of operating data.

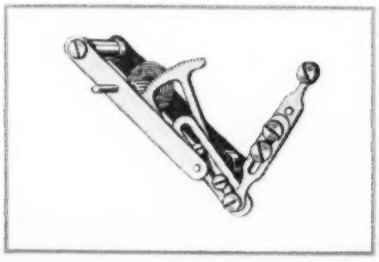
Representatives in Principal Cities

INDUSTRIAL RAILROAD COFFIN MARINE PRODUCTS

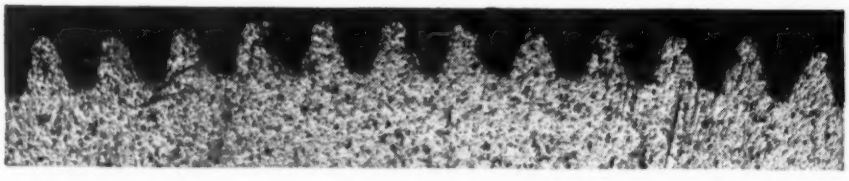
The J.S.COFFIN, JR., CO. 326 South Dean St. ENGLEWOOD, N.J.

HELICOID GAGES
Remain Accurate Longer

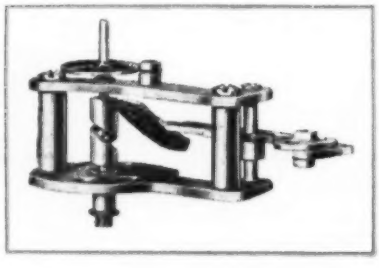
HERE'S WHY:



1 The movement of the ordinary pressure gage operates by means of a toothed segment and a spur gear as shown at right.



2 Magnified 12 times, the teeth of this new, unused sector are jagged – anything but uniform. Pinion teeth are cut the same way. Friction, wear and consequent inaccuracies are caused by these rough surfaces rubbing together.



3 Helicoid Gage movement has a polished, graphited Bakelite cam and a polished helicoid roller – instead of sector and pinion.

4 Cam of Helicoid movement magnified 12 times, shows smooth, polished surface. Helicoid roller surface is also highly polished. Longer wear and smoother operation result from these two polished surfaces in rolling, point contact.

Only Helicoid Gages have the Helicoid movement. That is one of several reasons why Helicoid is a better, longer-lasting pressure gage. Write for our complete catalog.

ACCO

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

TRADE MARK

year are Marshall B Dalton, W Cameron Forbes, Horace S Ford, Roger C Griffin, Royal Little, Henry G Powning, Charles E Spencer Jr, Raymond Stevens, Earl P Stevenson and Alexander Whiteside.

Heading list of new promotions at **Appalachian Electric Power Co** is E W Hogg, who has been transferred to Bluefield, W. Va., as assistant div manager of Bluefield district. He is taking over duties of J P Gills, who was appointed manager of Bluefield div succeeding Guy L Furr, who was transferred to Roanoke as assistant general manager of the company. **D P Minichan** succeeeds Hogg as district manager at Pulaski. Julius Hall Jr becomes commercial manager of the company at Roanoke and B D Painter succeeds Hall as commercial manager of Bluefield div. L L Koontz goes to Roanoke to become rural supervisor of Appalachian.

Sabin Crocker has been appointed mechanical engineering consultant of **Detroit Edison Co.** He will report in a staff capacity to Samuel M Dean, chief engineer of the system to undertake special assignments in field of system engineering. Harvey A Wagner has been made senior engineer-mechanical and will report directly to Dean. He will be responsible for operation of mechanical engrg section of engineering div. Fred A Compton has been named sales manager. Chester F Ogden has been made purchasing agent.

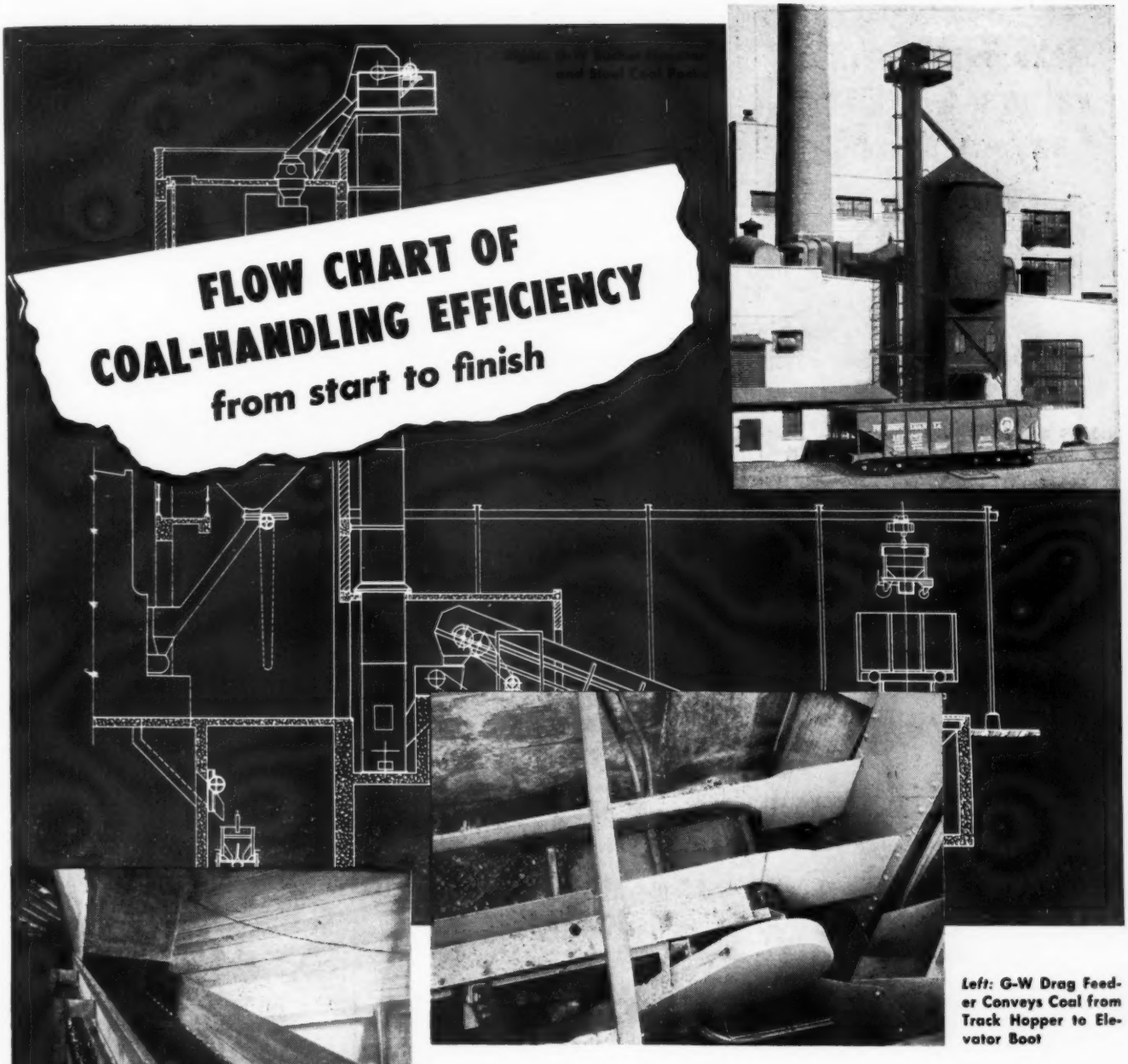
Organization changes in **Detroit Edison's** production dept are as follows: (1) George A Porter has been made assistant chief engineer of power plants, succeeding Walter D Drysdale, who retires after 42 years of service with the company. (2) Robert M VanDuzer Jr has been appointed operating engineer of power plants. (3) Virginius F Brown became mechanical maintenance engineer of power plants. (4) Henry E Macomber has been named mechanical engineer of power plants responsible for following new construction. (5) William W Brown is appointed engineer production-projects to assist Macombe in this work. (6) William A Hirt's title becomes engineer-production, load scheduling, and he continues in charge of load allocation to power plants.

Dr S P Darlington joins **Florida Power Corp** as resident engineer for power plants now under construction at Inglis and Benson Springs. R B Lee has been named research engineer, reporting to director of operating departments. He will assist chief engineers in conducting tests on power-plant operations and fuels.

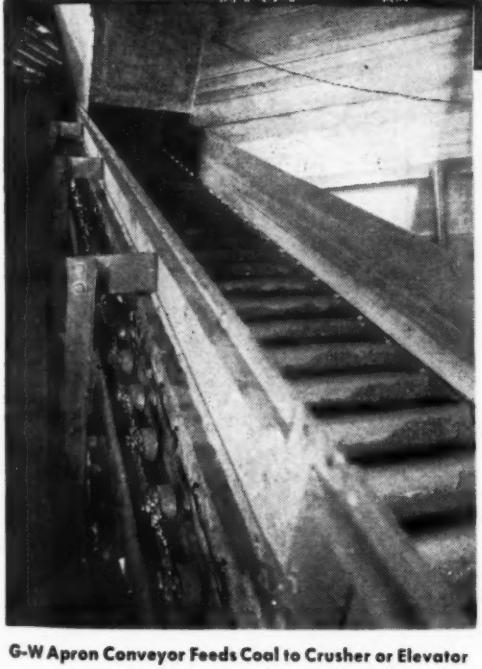
Raymond Rubicam was named chairman of **Committee for Economic Development** research and policy committee. Henry R Johnston was appointed executive director, and John H Van Deventer was chosen as director of information.

Appointment was announced of James E Baker as advertising manager, coal heating service div, **National Coal Association.** Baker will cooperate with coal-heating service groups in all parts of the country in preparation of their advertising

FLOW CHART OF COAL-HANDLING EFFICIENCY
from start to finish



Left: G-W Drag Feeder Conveys Coal from Track Hopper to Elevator Boot



G-W Apron Conveyor Feeds Coal to Crusher or Elevator

Here's a flow chart of one basic G-W system as it moves coal from track-hopper to ash disposal — a continuous operation from start to finish. This typical G-W System can be adapted to any plant's requirements.

Every detail of design, manufacture and erection is the sole responsibility of Gifford-Wood. The G-W Complete Coal-Ash Handling System gives you the latest efficiencies of design based on more than 130 years of specialization in complete material handling equipment. You have the assurance, with a G-W System, that every penny of your equipment dollar is going to increase coal-handling efficiency in your plant.

GIFFORD-WOOD CO.

420 LEXINGTON AVE.
NEW YORK 17

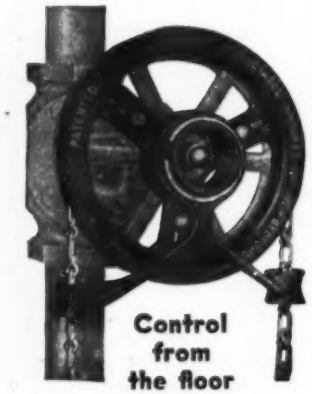
565 W. WASHINGTON AVE.
CHICAGO 6

Factory: Hudson, N. Y.

G-W HANDLES IT...
faster • easier • cheaper

GIFFORD-WOOD
SINCE 1814

Make Your Overhead Valves SAFE and Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.

New Bedford, Mass.

EXTRA SERVICE

"STANDCO"

PILLOW BLOCKS

There's Extra Value in these rugged, well-designed Standco Pillow Blocks with their life-long, trouble-free service.

They are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

Write for Bulletin.

"Unbrako" and "Hallowell" Products are sold entirely through distributors

Over 44 Years in Business

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 577

Boston • Chicago • Detroit • Indianapolis
St. Louis • San Francisco

and promotion material and he will also direct work of coal-heating service div's advertising agency, Buchen Co, Chicago. Baker's headquarters will be at Washington, D. C.

Henry A Mullen, of Ampco Metal, Inc, Milwaukee, has been elected chairman of alloy group of **Resistance Welding Manufacturers Association** for 1947.

Harold H C Lasker has organized **Harold Lasker Co** for production and construction of fabricated plate and structural steel and special industrial equipment. Lasker Engrg Co will continue in business in a professional engineering capacity and will act as sales representative of Harold Lasker Co.

Samuel P Densmore and Henry B Madden announce that they are now trading as **Power & Combustion Equipment Co,** 511 Park Ave, Baltimore 1, Md., for Todd heavy-oil burners, Hayward light-oil burners, boilers, industrial ventilation and pumps.

Announcement was made by **American Society of Refrigerating Engineers** of resignation of David L Fiske, secretary of that organization since 1927.

G W Marshall Jr, general manager of asbestos textile and packing div, Raybestos-Manhattan, Inc, Manheim, Pa., was elected president of **Asbestos Textile Institute.**

Jay Gould Coutant, fuel engineer, specialist in fuels, combustion and steam generation, has joined **Barium Steel Corp** to supervise the fuel and refractory activities of Barium's subsidiary companies.

OBITUARIES

E H Jeffords, 71, director of Raybestos-Manhattan, Inc, and general manager of general asbestos and rubber div, N. Charleston, S. C., died Dec 12 in Charleston, S. C.

Raymond P Walters, 52, stationary engineer at Nichols School in Buffalo for many years, died recently after a long illness.

Jesse F Spaulding, 64, stationary engineer at Bethlehem Steel plant in Lackawanna, N. Y., died recently at his home after an illness of two weeks.

Louis Hall, 63, stationary engineer at Packard Motor Co in Buffalo, died at his home recently of a heart attack.

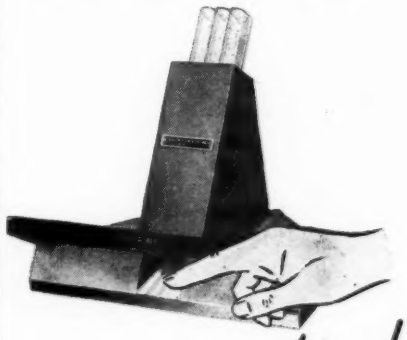
Richard Ransom Case, 84, for many years connected with Virginia Public Service Co, died Feb 2 at his home in Hampton, Va.

H Hobart Porter, 81, noted mining engineer and chairman of board of American Water Works & Electric Co, died at his home in New York City on Feb. 9. In 1894, with the late E N Sanderson, he founded engineering firm of Sanderson & Porter, from which he retired a few years ago after almost 50 years of active association.

George H Dyer, 46, power supervisor, Oxford Paper Co, Rumford Falls, Me., died Feb 4 after a brief illness.

With Taylor Equipment

YOU CAN DETERMINE MOST BOILER WATER RESIDUALS IN ONE TO TWO MINUTES!



There's the Value!

You get Speed . . . with a simple, three-step operation!

You get Simplicity . . . no handling of fragile Nessler tubes!

You get Accuracy . . . Liquid color standards carry an UNLIMITED guarantee against fading!

You get Economy . . . standard slides, for silica, chlorine, ammonia, pH, etc., may all be used on one single base!

You get Durability . . . sets are sturdy, light in weight, extremely portable!

You get Convenience . . . no single standards to handle. Complete sets of color standards enclosed permanently in slides.

GET THIS BOOK . . .

"Modern pH and Chlorine Control" . . . 88 pages give detailed information on Taylor methods and equipment . . . theory and application in 34 basic industries. Makes recommendations for many types of power plant needs . . . use it as a reference book. Ask your dealer or write to . . .

W. A. TAYLOR AND CO.
YORK & RODGERS FORGE RDS. • BALTIMORE 4, MD.

1,125,000 POUNDS PER HOUR of feed water are pumped by three BJ Boiler Feed Pumps in the operation of this magnificent 65,000 KW Steam turbine-generator set (Manufactured by Westinghouse)... at the City of Los Angeles Harbor Steam Plant.

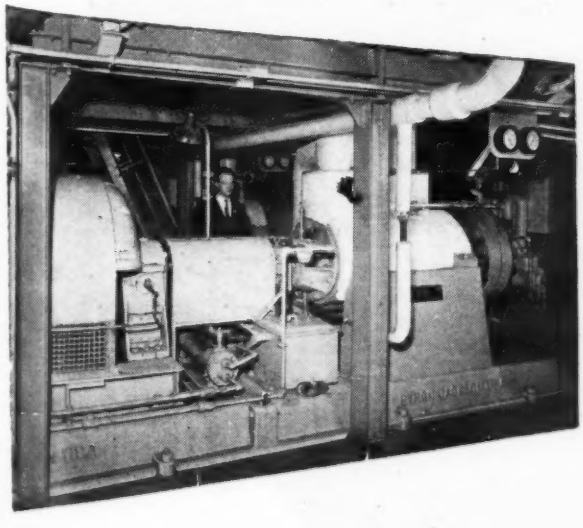
FOR LARGE, MODERN HIGH PRESSURE HIGH TEMPERATURE POWER PLANTS

BJ

DOUBLE CASE, DOUBLE VOLUTE

Boiler Feed Pumps

ON THE FLOOR BELOW... One of the three 6" by 11", 9-Stage, double case BJ Boiler Feed Pumps. Each pump delivers 375,000 pounds per hour of feed water. *Water temperature:* 360°F; *Total Differential Pressure:* 1250 psi; *Drive:* 900 hp, 3 phase, 60 cycle motor.



The Double Case, Double Volute Boiler Feed Pump, a Byron Jackson Co. development, is superior to any other design for feeding High Pressure, High Temperature Boilers in Modern Power Plants. Outstanding features of this pump include:

HORIZONTALLY SPLIT INNER CASE

AXIAL & RADIAL THRUSTS ELIMINATED

HEAVY BOLTING OF HORIZONTAL SPLIT NOT REQUIRED

BALANCE DISK, DRUM OR FLOATING SEAL NOT USED

LOW STUFFINGBOX PRESSURES

EASILY & QUICKLY DISMANTLED & REASSEMBLED

Capacities: to 1,000,000 lbs. per hr.
Pressures: 1,000 to 2,800 psi.

Byron Jackson Co.
LOS ANGELES 54, CALIFORNIA
Offices in Principal Cities

Where There's a Smoke Stack

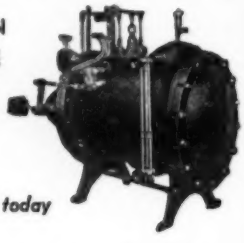
THERE'S NEED FOR

A STERLING CONDENSATE

LIFTING UNIT

Often returning condensate in excess of 300 degrees F. the STERLING STEAM LIFTING UNIT stops short circuiting of pressures, removes excess back pressures, operates on either high or low pressure and is adaptable to any horsepower. Old or new installations show definite savings.

OPERATES ON AIR PRESSURE AS WELL AS STEAM



Send us your steam problem today

Sterling Engineering & Mfg. Corp.
(Templeton Mfg. Co.)
110 Business St.,
Hyde Park, 36, Massachusetts

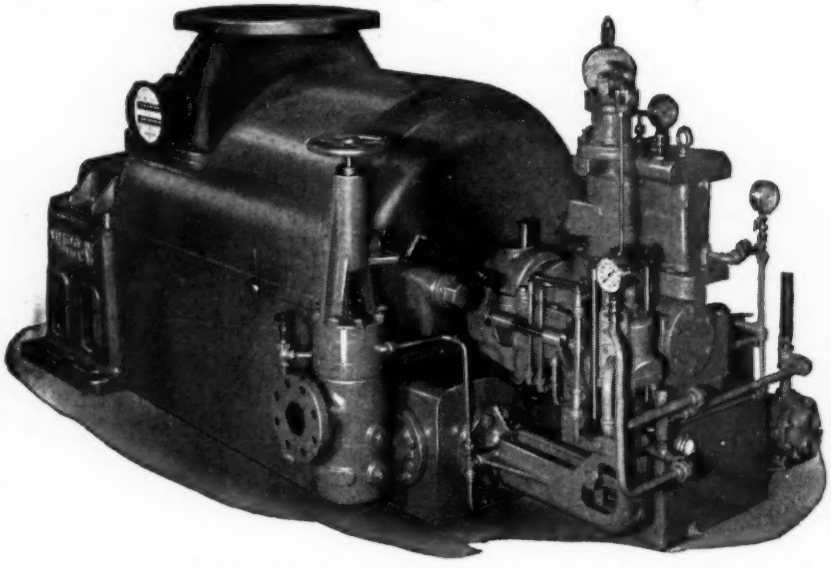
SCHERR
DIAL TEST INDICATOR

Essential in shop repair jobs and in checking alignment of coupled equipment. Reads in thousandths on large dial in which fractional parts of thousandths are easily noted. Sustained accuracy—only 3 moving parts. Universal ball-joint back. Contact points hardened and ground. Set includes clamp, holder with bar, magnetic base (optional), internal measuring attachment, 3 contact points.

FULL DETAILS IN THE SCHERR SMALL TOOL CATALOG

which also describes and illustrates Scherr Tachometers and Speed Indicators, Micrometers reading to 1/10,000", Calipers, and other Scherr precision equipment. At your request.

GEO. SCHERR CO., Inc.
196-A Lafayette St.
New York 12, N. Y.



One of two MURRAY multistage steam turbines, designed to deliver 685 horsepower on steam at 110 pounds and exhausting to 26½ inches Hg vacuum, furnished to drive high speed centrifugal compressors for refrigeration in one of the most prominent Southern Hotels. A third unit has recently been shipped. Equipment includes variable speed oil relay governor, trip and throttle valve, strainer surrounding the double seated balanced governor valve, and force feed lubrication.

MURRAY
MULTISTAGE STEAM TURBINES

★ ★ ★ ★

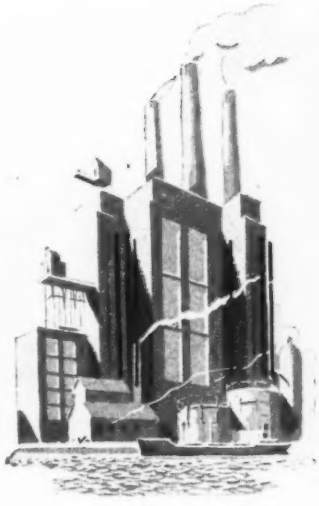
The complete MURRAY line of steam turbines includes all variations of mechanical drives, and turbine generator sets up to and including 3000 KW rating.

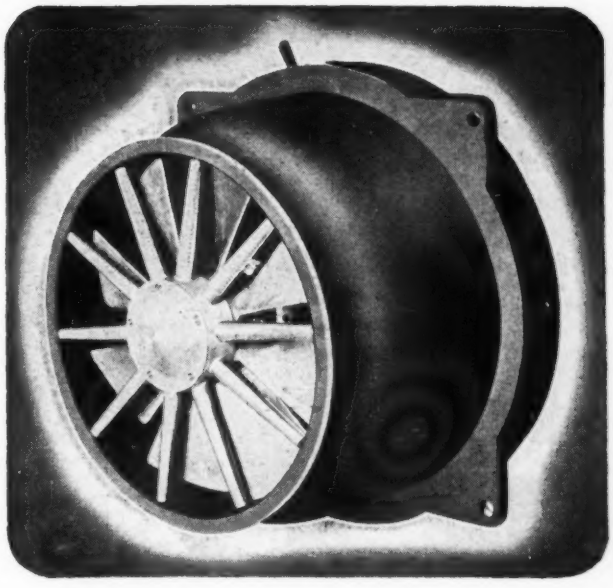
Sales Representatives for Murray products are located in all principal cities.

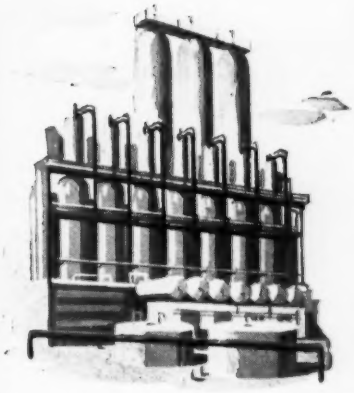
MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

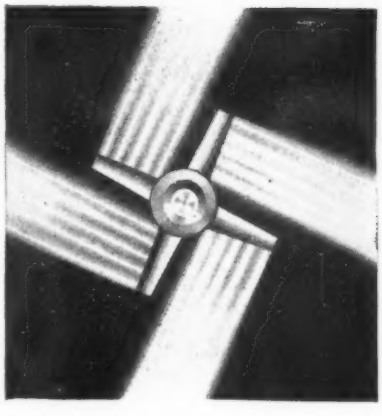






"PINWHEEL ACTION" BURNER

INCREASES BOILER RATINGS



Coppus-Dennis FANMIX Uses New Principle to Create "Flameless Fire" and Get More Heat from Gas or Oil

Greater heat release results from the unique Dennis principle of combining fuel with air in a perfect mixture to provide truly radiant heat — "flameless fire".

On natural gas, for example, FANMIX provides complete combustion with less than 5% excess air in the product of combustion leaving the furnace.

Increase ratings of equipment now operating at limit of present burners. Install FANMIX . . . easily, economically . . . and get more heat.

Coppus engineers FANMIX Burners for individual applications. Complete control over rate of combustion or "flame pattern" can be provided to meet the requirements of any installation. Coppus Engineering Corporation, 163 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

"Pinwheel Action" Gives Perfect Proportioning

Fuel escaping from orifices in rotating driver arms, rotates the fan, which draws in air at right angles to the path of the fuel. The energy in the fuel under pressure is utilized to perform work by mechanically mixing and proportioning the fuel automatically with just the required amount of air.

This homogeneous mixing secures complete combustion. Uniform temperature conditions exist throughout the furnace with complete absence of drifting "hot spots".

New Installations — FANMIX Cuts Investment Cost

Smaller combustion space — furnace is relieved of having to serve as mixing chamber. Less stack — FANMIX creates its own forced draft, overcoming draft loss across the burner. No forced draft equipment — FANMIX draws air for combustion through air-cooled walls or floors.

2 Types — Straight Gas or Combination Gas-Oil

Combination burners burn either oil or gas in entirety or in any proportion. No oil guns needed.

ANOTHER

COPPUS

"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
163 Park Ave.,
Worcester 2, Mass.

New Bulletin Will Tell You How to Increase Thru-Put of Your Gas- or Gas-Oil Fired Equipment.

Please send me Bulletin 410-4

Name.....

Company.....

Address.....

6 out of 10 manufacturers of original equipment SPECIFY USG

U. S. INSTRUMENTS Tell The Truth

UNITED STATES GAUGE

Tomorrow's accuracy is here today in the new U. S. Supergauge. Get complete information about this superb instrument now.

DIVISION OF AMERICAN MACHINE AND METALS, INC., SELLERSVILLE, PENNA.
Manufacturers of Pressure, Temperature, Flow and Electrical Measuring Instruments

USG

MULTOMETER SYSTEM CONTINUOUS BOILER BLOW-OFF

CONTROL BLOW-OFF within exact and economical limits...

Weighs only 40 lbs.

As long as it is necessary to "blow" boilers, why not do it with the assurance of direct and constant benefits?

Because of the efficient operation of the MULTOMETER SYSTEM you get such results as—(1) increased efficiency of steam generation . . . (2) reduction in fuel costs . . . (3) you stop wet steam, foaming, and priming . . . (4) boilers are kept clean and free of scale.

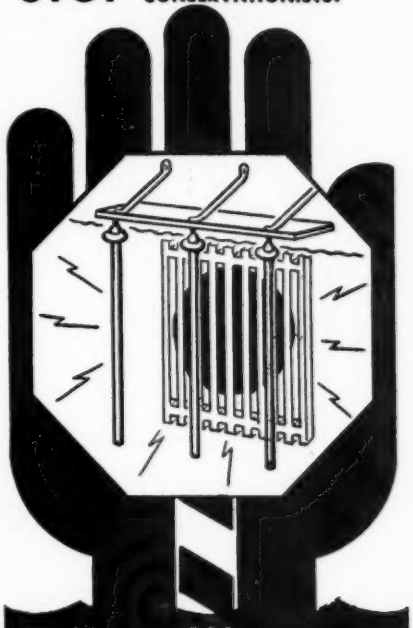
The MULTOMETER is adapted for use with every kind and size of boiler and every character of feed water.

We supply complete data and working drawings showing the best method of installation on various types of boilers.

A survey of your operation, including analyses of both feed water and boiler water, is available without cost or obligation. Let us show you what the MULTOMETER SYSTEM will do in your plant.

P. E. MADDEN & COMPANY
352 W. WALTON ST. CHICAGO 10, ILL.

STOP NEEDLESS DESTRUCTION OF FISH!
STOP HEAD LOSS . . . AT YOUR INTAKES!
STOP SCREEN MAINTENANCE WORRIES!
STOP CRITICISM . . . FROM CONSERVATIONISTS!



AN INVISIBLE BARRIER

YOUR ZONE of PROTECTION

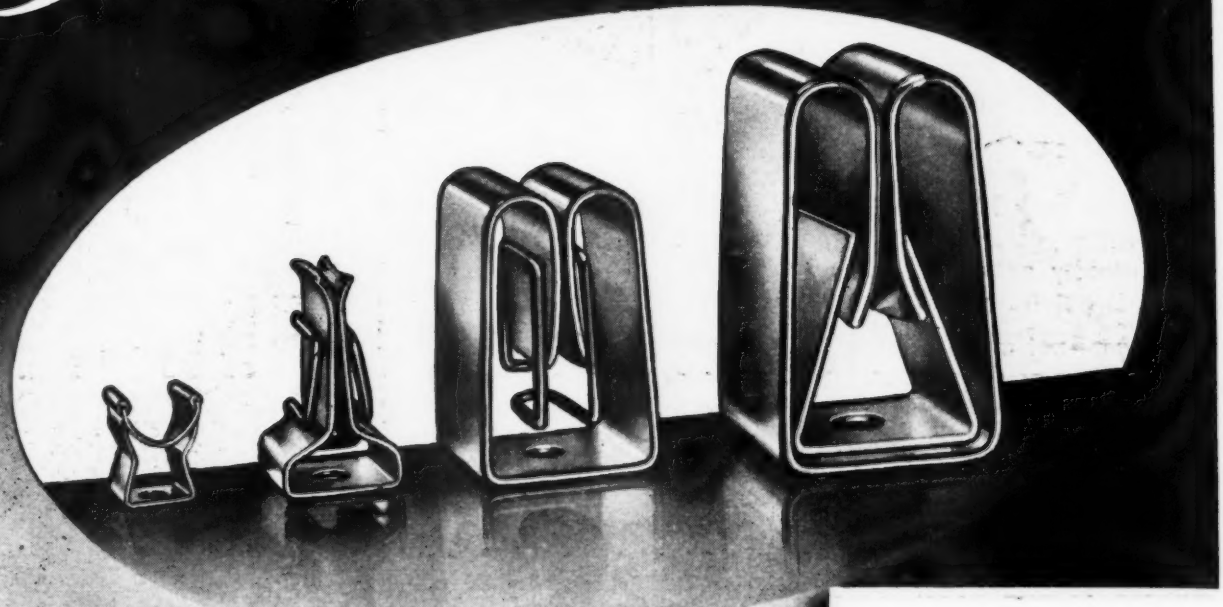
Burkey Electric Fish Screens solve your fish control problems—cheaply, effectively, harmlessly. Electronic impulses keep fish of all sizes *safely* away from intakes or outlets. The electrode systems are custom-built for your particular intake—designed to permit a full head of water. No screen cleaning necessary.

Every Burkey installation is engineered to your problem regardless of size. Burkey Electric Fish Screens are thoroughly proven by years of service in condensing water intakes, hydroelectric plants, water systems and industrial pumping installations. Recommended by State Conservation Officials.

★ SEND FOR LITERATURE AND QUOTATIONS

ELECTRIC FISH SCREEN CO.
1130 N. Poinsettia Place • Hollywood 46, Calif

Positive Pressure FUSE CLIPS

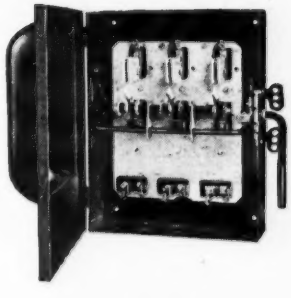


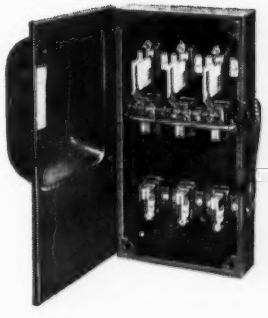
. . . an exclusive feature of all Square D Safety Switches

What do these fuse clips add to overall safety switch performance? Plenty!

- They reduce heating at contact points by 60%, compared with conventional type clips.
- Copper instead of bronze, they afford substantially more conductivity.
- Lower contact resistance because of higher contact pressure.
- Design permits easy insertion and removal of fuses, notwithstanding the higher contact pressure.
- The Positive Pressure is automatic. It requires no bolts or clamps. It is immune to the loosening effect of vibration, wear or thread stripping.

This is one of many basic features which have placed Square D safety switches in the number one preference spot.





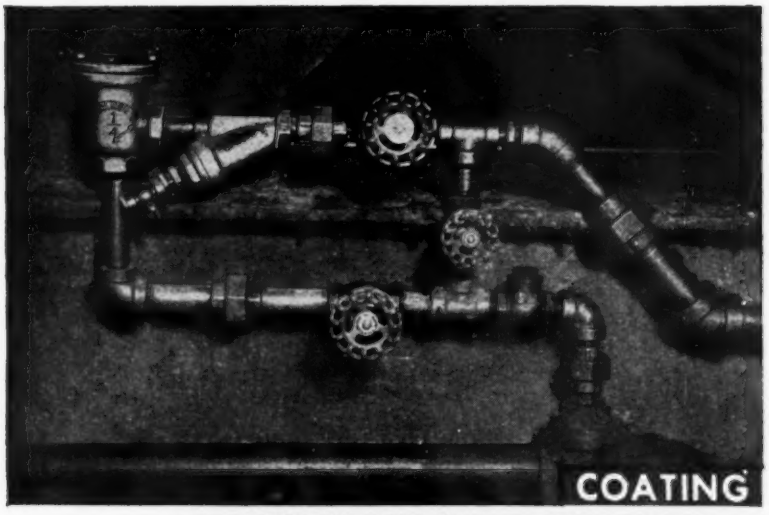
Write for BULLETIN 500 which describes Square D's complete safety switch line and all its features. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

NOW TWICE AS GOOD—

THE NEW SARCO THERMOSTATIC STEAM TRAP

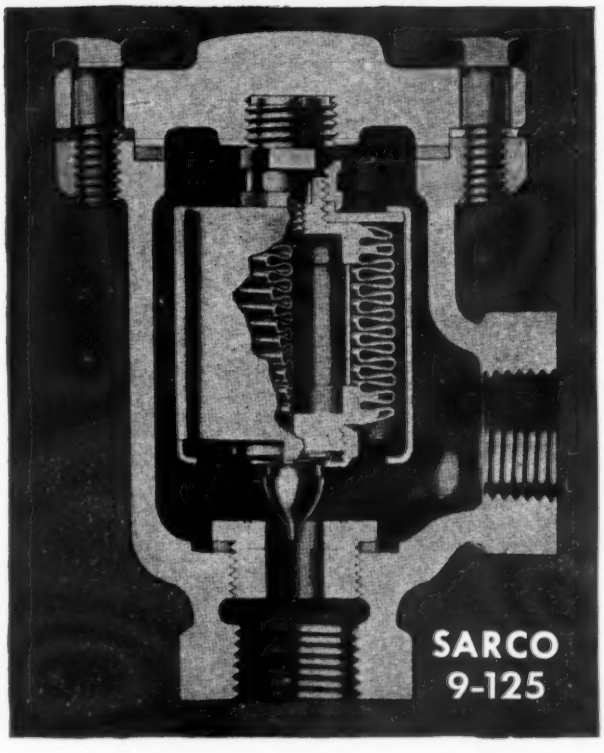


Whenever a better thermostatic steam trap is made, it will still be called "Sarco No. 9." The latest improvement, after years of development spurred on by the tremendously expanded use of this trap in the war effort, is now ready for you in the new 9-125 series.

No larger—not much change in appearance—but the valve orifices are larger and the capacity for discharge of *condensate* or *air* is doubled over the entire range of sizes.

HERE ARE SOME OF THE ADVANTAGES:

1. In process work, cooking time is governed more by air venting than trap capacity or speed. Actual output of cooking and similar equipment will be greatly increased.
2. The new No. 9 will operate almost as fast as a bucket trap—but have full capacity at condensate temperatures within 20 degrees of the steam. It is thermostatic trap efficiency with bucket trap capacities—a whole new field of applications for the No. 9.
3. Like other No. 9's, this trap is wide open when cold. It can't freeze. It requires no seat change when pressures change. It is small, inexpensive and easy to install.
   Ask for Bulletin No. 250.



161

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
475 FIFTH AVE., NEW YORK 17, N. Y.
SARCO CANADA, LTD., TORONTO 1, ONTARIO

Where High Temperatures and Pressures Prevail—Beware!

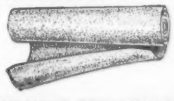
Ordinary gaskets
and sheet packings create grief
and wasted dollars

FOR A FEW PENNIES MORE the best in sheet packings and cut gaskets are available and in the long haul actual savings in time and money make the best—the least expensive.

It is no secret that in a few remote industrial applications, a piece of rope or a sheet of tough paper has been known to serve as a packing . . . and well! But where high pressures and temperatures exist—of course never! And ordinary gaskets and sheet packings are little better than a piece of rope or wrapping paper. Use the finest . . . Palmetto Sheet Packings and Gaskets. A few are sketched below with descriptions of service.

PALMETTO SUPERSHEAT . . . Finest quality general utility jointing material . . . compressed asbestos sheet made from asbestos fibre and a special bonding agent to withstand high pressure and temperature . . . compressible and resilient . . . exceeds Navy and Federal Specifications . . . cuts easily and clearly.

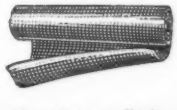
PALMETTO HI-4 OIL PROOF . . . Meets Aeronautical Material Specification 3232D . . . compressed asbestos sheet made from asbestos fibre and a special bonding agent . . . completely resistant to oils and gasoline . . . also withstands high temperatures . . . has wide applications in oil refineries, aviation and automotive industries.



PALMETTO HANDHOLE AND MANHOLE GASKETS . . . Exceptionally resilient and compressible . . . resist high pressure and temperature . . . each gasket carefully blocked by hand to accurate size.

PALMETTO METALLIC GASKET TAPE . . . Ideal for making gasket strips of special shape or size . . . folded for strength . . . coated with heat-resisting compound for high temperature service.

PALMETTO METALLIC SHEET PACKING . . . The strong, brass wire-inserted asbestos cloth from which the above gaskets and gasket tape are made. Supplied with a heat-resistant coating, and widely adaptable for cutting gaskets for engine cylinder heads and other irregular shapes.



Write for further data on Palmetto Packings (*coupon opposite is for your convenience*). GREENE, TWEED & CO., North Wales, Pa.

PALMETTO 2200

A High Pressure Spiral

THAT'S NOT ALLERGIC TO LUBRICATING OILS

Many high pressure packings are tough enough to withstand gruelling punishment from heat and pressure but when lubricating oils begin their deteriorating attack, *ordinary* High Pressure Spiral packing quickly disintegrates causing possible equipment damage, loss of time and loss of money.

Palmetto 2200 gives you *complete protection* while it stands up and serves throughout its long life. This *oil proof* High Pressure Spiral because of a special binder, years of "know how" and the finest materials available will resist *all* the harmful effects of oil, heat and water.

All Palmetto Packings enjoy an enviable reputation . . . Write for descriptive literature.

GREENE, TWEED & CO. — NORTH WALES, PA.

PALMETTO Packings

In the United States and Canada There is a Distributor Near You

P-147

SEND THE COUPON *Today*

GREENE, TWEED & CO., North Wales, Pa.

☐ Send literature please ☐ Send a representative please

NAME_____ TITLE_____

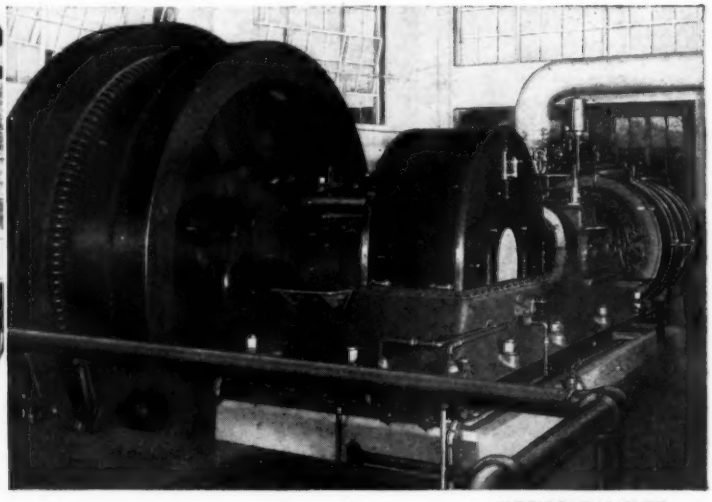
FIRM_____

ADDRESS_____

CITY_____ STATE_____

Skinner "UNIVERSAL UNAFLOW" Steam Engines

VERTICAL TYPE



HORIZONTAL TYPE

• WHAT THEY ARE

The Skinner "Universal Unaflow" Steam Engine is the outstanding reciprocating prime mover of this era, made by the largest exclusive manufacturer of steam engines in America. The performance of thousands of "Universal Unaflow" engines, in almost every type of industry and institution, daily demonstrates the truth of our claim—that they are "the most economical steam engines built."

"Universal Unaflow" engines are correctly designed for simplicity, dependability, heavy duty service, flexibility, and permanently maintained economy. They are available in sizes ranging from 75 to 2,250 horsepower, and in horizontal or multi-cylinder vertical types.

• WHAT THEY DO

Skinner "Universal Unaflow" Steam Engines are built for direct connection, coupling, or belt drive, to electric generators, compressors, blowers, pumps, lineshafts, or other load.

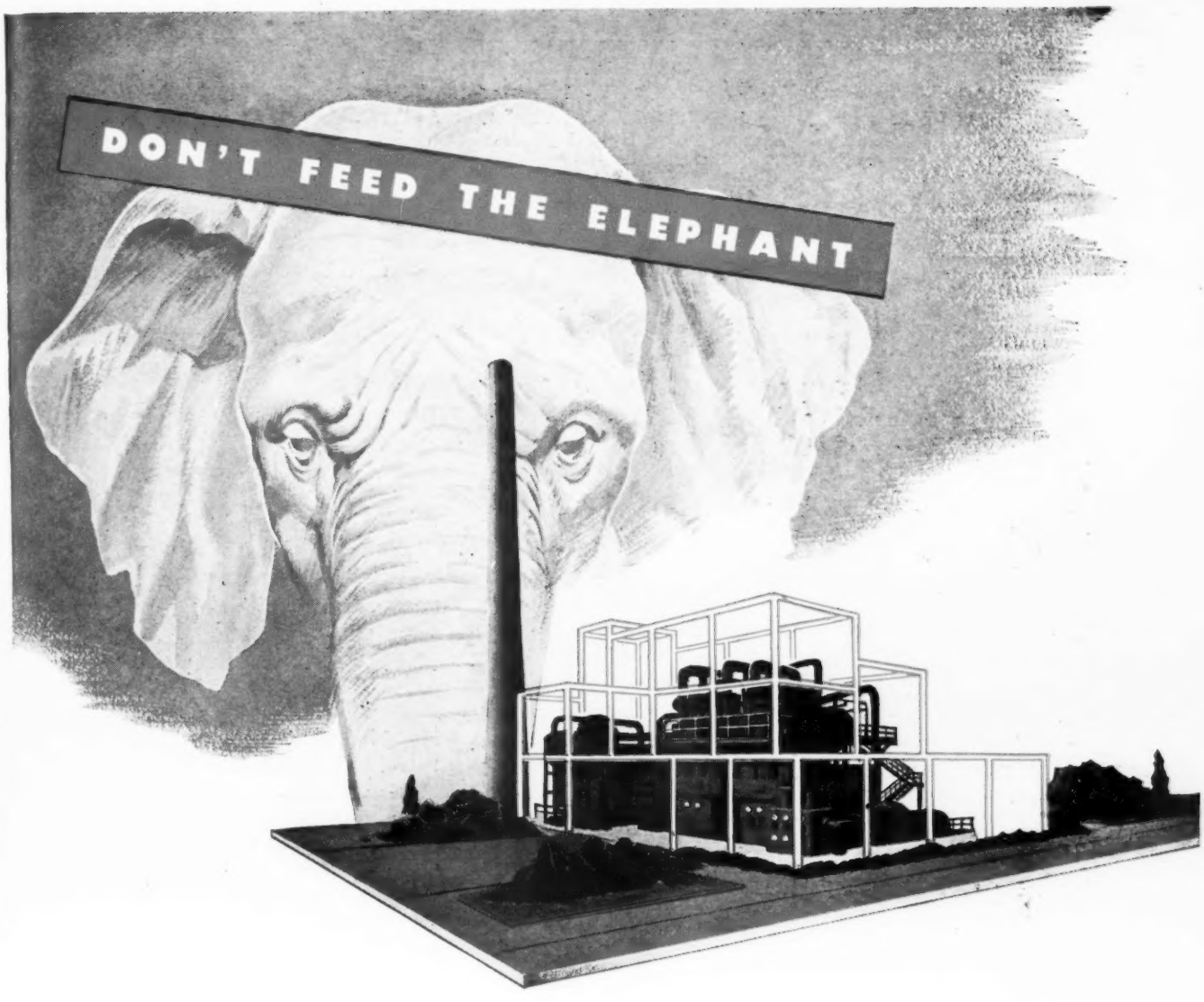
Over 2000 power users, in industries and institutions, have found it more economical to generate their own power with "Universal Unaflow" engines than to purchase power from the local utility, or to generate power with other prime movers.

Exhaust steam is available to be utilized for heating, for laundry, for processing techniques, and many other purposes, further adding to the savings enjoyed through use of "Universal Unaflow" engines.

Skinner "Universal Unaflow" engines are frequently bought under our Guaranteed Saving Contract, payments being made out of proved savings after the engine is in service. Write for detailed information of the advantages of Skinner "Universal Unaflow" engines in your industry.

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.



. . . ESPECIALLY IF YOU HAVE A WHITE ONE LIVING ON YOUR BOILER PLANT.

This white elephant is an inadequate water conditioning service that *feeds on profits* by causing excessive blowdown, scaling, corrosion and foaming.

There's no *one* solution to all boiler water problems. It takes more than just adding a few chemicals to the system. Good results require a complete, *individualized* water conditioning service that includes initial investigation, plant control, a daily testing program, periodic check-ups, analyses of water samples and regular engineering reports on plant operation. Such a service is rendered by the Betz organization. Write today for details on what Betz engineers might do for you. W. H. & L. D. BETZ, Gillingham & Worth Streets, Phila. 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

Announcing

BRITISH INDUSTRIES FAIR

LONDON & BIRMINGHAM, MAY 5—16, 1947

This is your first opportunity in seven years to see your old suppliers in Britain and to meet new ones.

Overseas Buyers are invited to Britain for the 1947 British Industries Fair. It will enable them to establish personal contact with the makers of the immense range of United Kingdom goods displayed in the London (Lighter Industries) and Birmingham (Hardware & Engineering) Sections of the Fair. The careful grouping of exhibits will assist buyers to compare the products of competing firms with a minimum of time, trouble and expense. Special arrangements to suit individual markets can be discussed and terms and conditions of business settled direct with the manufacturer, since only the actual producer or the sole selling agent may exhibit.

★ *For full details of the* 1947 *Fair apply to the nearest British Commercial Diplomatic Officer or Consular Officer, or the British Trade Commissioner in your area.*

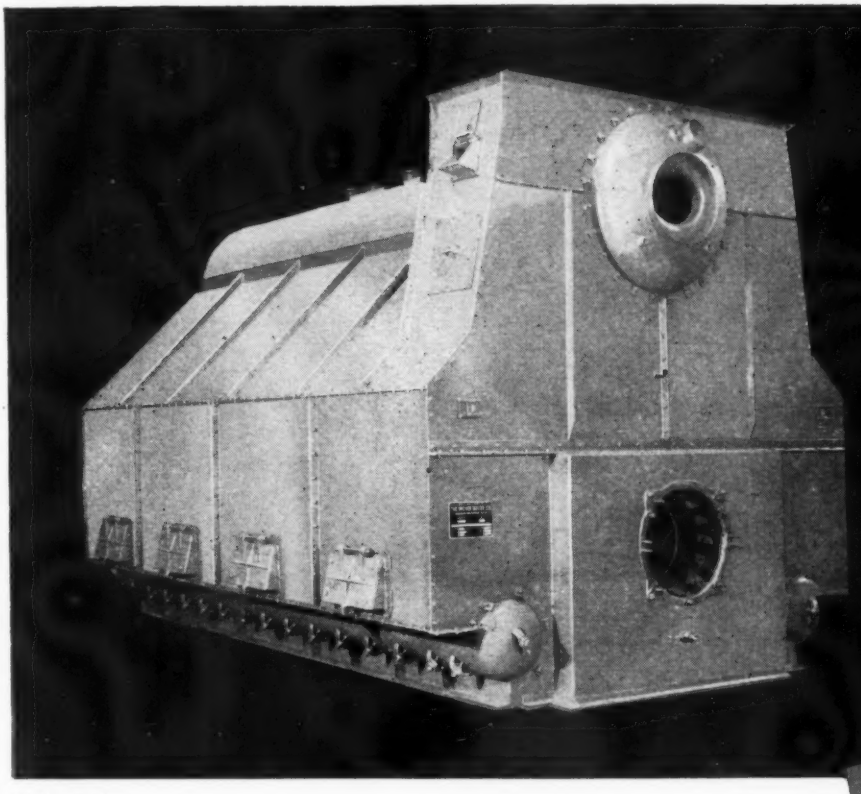
BRITAIN PRODUCES THE GOODS

ENGINEERING PLANT and EQUIPMENT will be shown in Birmingham

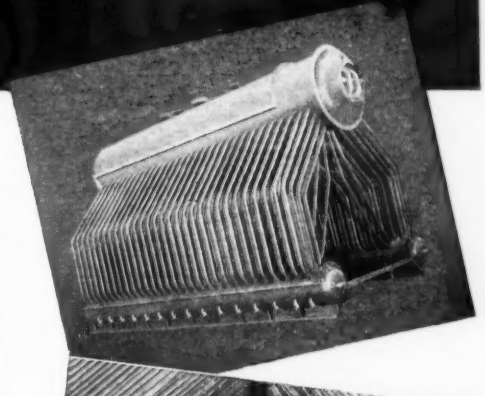
PACKAGE POWER EFFICIENCY FOR YOUR PLANT

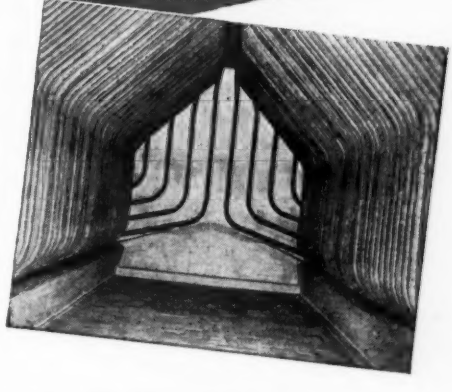
WITH WICKES

CROWN TYPE-A BOILERS



- Specially designed so that each furnace wall is a separate steam generator as well as an integral part of boiler unit.
- Drums fully protected against intense furnace heat.
- Front and rear refractory surfaces protected with waterwalls.
- No complicated headers or circulating tubes to require frequent maintenance and repair.
- Conserve head room and floor space.



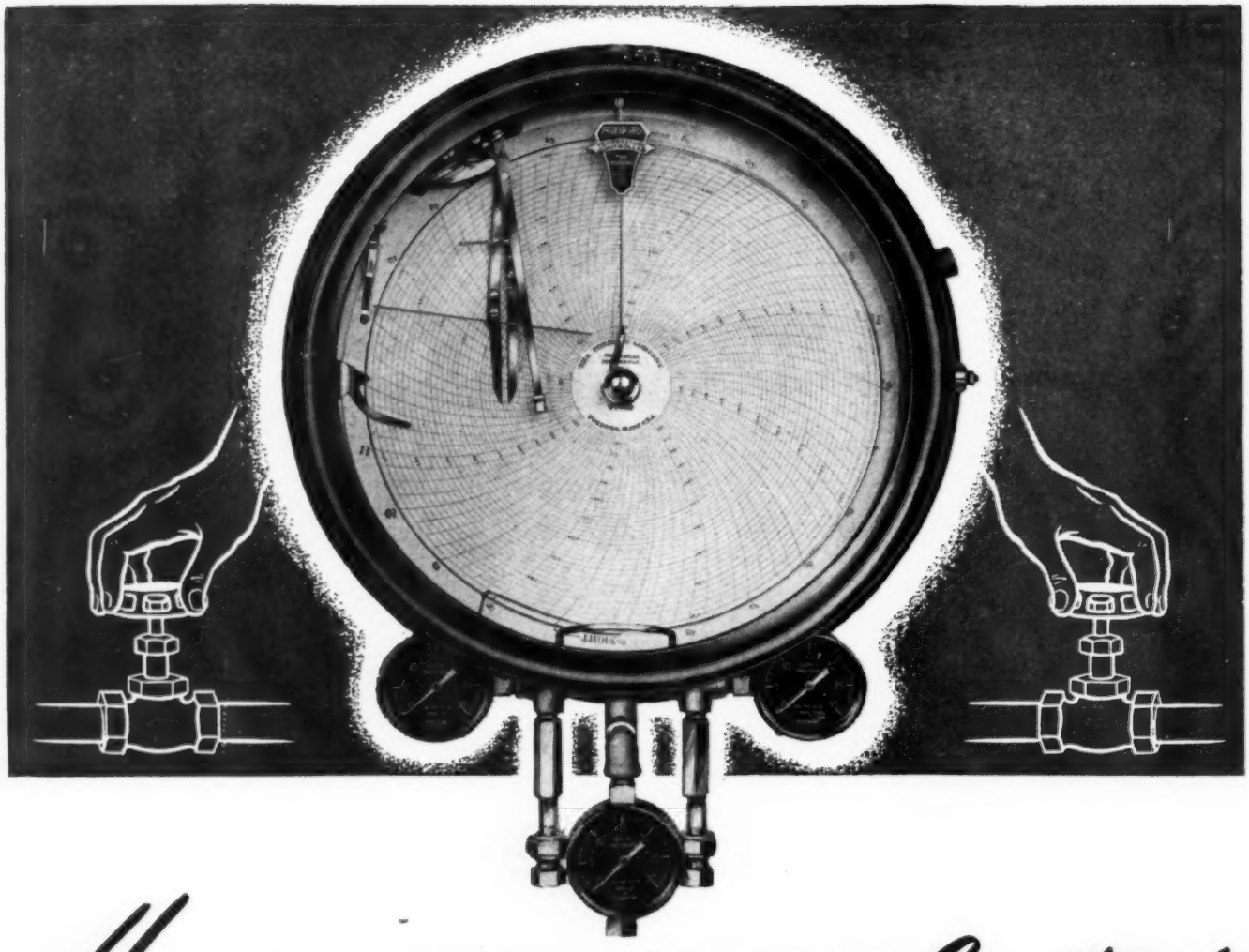


WICKES PACKAGE CROWN TYPE-A BOILERS typify the combined engineering knowledge and expert workmanship that for nearly a century have distinguished all Wickes products. Patterned after our line of large Crown Type-A Boilers, the Package Unit is engineered for pressures up to 500 p.s.i. and for capacities of 20 to 250 nominal horsepower. Compact, efficient, they are produced as a steel-cased package unit and are shipped ready for operation with a minimum of installation problems. Send us your boiler requirements and our engineers will be glad to determine how Wickes Crown Type-A or other Wickes boilers can increase power efficiency in your plant.

SALES OFFICES: Atlanta • Baltimore • Boston • Charlotte, N. C. • Chicago • Cincinnati • Detroit • Fort Worth, Texas • Indianapolis • Jacksonville • Milwaukee • New York City • Peoria, Ill. • Pittsburgh • Saginaw • San Francisco • San Jose, Calif. • Seattle • St. Louis • Tulsa, Okla. • Mexico City.

THE WICKES BOILER CO.

SAGINAW, MICHIGAN, U.S.A. • RECOGNIZED QUALITY SINCE 1854



Here's "AMBIDEXTROUS" *Control*

THAT AUTOMATICALLY OPERATES TWO VALVES!

Wherever process temperature, pressure or humidity must be controlled by adjustments of two valves, the Foxboro Duplex Controller gives you two dependable, accurate "hands" that need no supervision. It combines 2 single-action valve control systems actuated by a single measuring system.

All you need to do is set the "high" and "low" indicators at desired points. The controller automatically "manipulates" one valve if the process condition reaches the high point; or the other valve at the low point.

What's more, both adjustments may be definitely fixed at specified degrees, percentages, or pounds-per-square-inch to maintain an exact differential between high and low points.

Typical advantageous uses of Foxboro Duplex Controllers are listed in the panel. Detailed information on their application to your problem may be obtained by sending a description of your process. Write **The Foxboro Company, 182 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities.

TYPICAL APPLICATIONS

1. Dry Kilns – for humidity control. One "hand" of the Duplex Controller operates steam spray valve; the other adjusts the vent.

2. Air Conditioning – without supervision, a Duplex Controller accurately controls heating and cooling, or humidifying and de-humidifying.

3. Dryer Rolls (as in paper mills) – Foxboro Duplex Controller automatically controls two valves to utilize exhaust steam or live steam for greatest economy and uniform temperature.

4. Exothermic Processes, such as electroplating and polymerizing. Through accurate control of 2 valves, Duplex Control automatically adds or removes heat to maintain correct temperature.

FOXBORO
REG. U. S. PAT. OFF.

DUPLEX CONTROLLERS

GET TO THE POINT

WITH AMSCO-NAGLE INDUSTRIAL PUMPS

AMSCO-NAGLE PUMPS GIVE GREATER SERVICE

Amsco design covers the two points that really determine the value of an industrial pump: (1) The service it will give and (2) The ease with which it can be maintained . . . any pump, worthy of the name, will handle the actual pumping.

Every feature of Amsco-Nagle Pumps is designed to resist abrasion and impact. Wide impeller clearances allow free passage of debris-laden liquids. Casing, impeller, and end plate are only parts contacting material being pumped—bearing housing is completely sealed off from water end. Anti-friction bearings are arranged to handle heavy loads. An example of Amsco's striving for the utmost in durability is the use of manganese steel, "the toughest steel known", for shells, impellers, sideplates and liners.

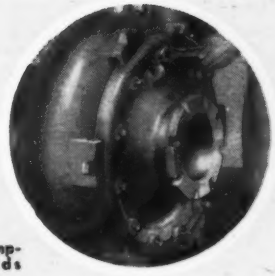


Figure 1—Clamping ring holds end plate.

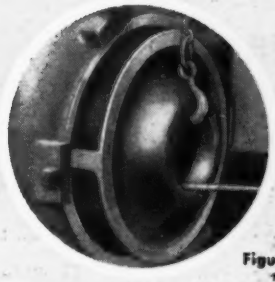


Figure 2—Impeller screws off.

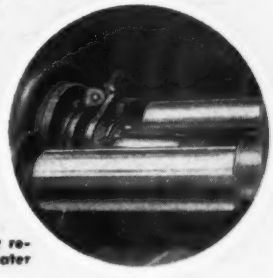


Figure 3—Easy removal of water end.

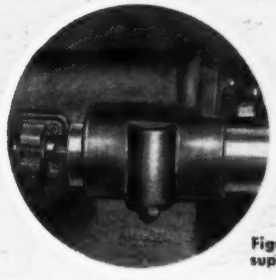


Figure 4—Tubular supports clamp in housing.

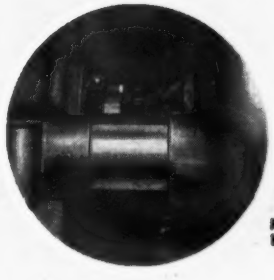
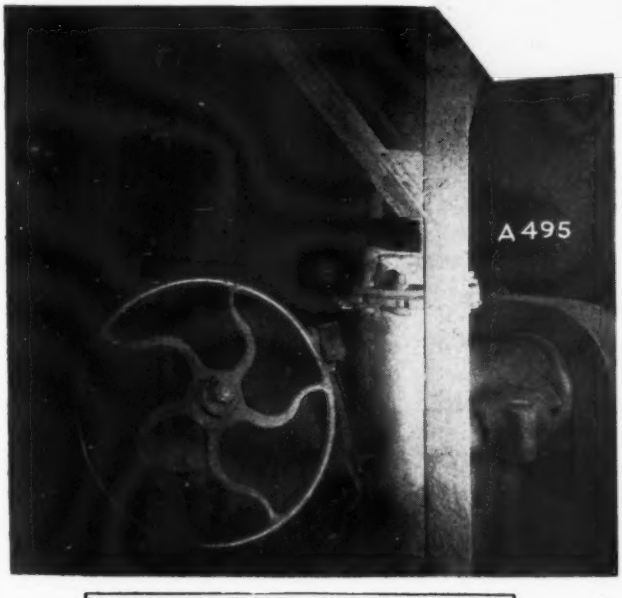


Figure 5—Accessible stuffing box.



AMSCO-NAGLE PUMPS ARE EASIER TO MAINTAIN

Water end parts subjected to wear can be adjusted or replaced easily and quickly. End plate comes off by simply removing clamping ring (clamping dogs on some models) — see Figure 1. Impeller screws off — see Figure 2. Or entire water end can be removed —see Figure 3. Tubes on casing clamp in bearing housing as shown in Figure 4— horizontal jack screw adjustment before tightening clamp bolts assures positive alignment of impeller in casing. Stuffing box readily accessible between tubes — see Figure 5.

Write for Bulletin describing these pumps.

Typical power plant installation of an Amsco-Nagle, 6", Type "T", Ash Handling Pump.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo.
Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Que.

COST CUTTERS

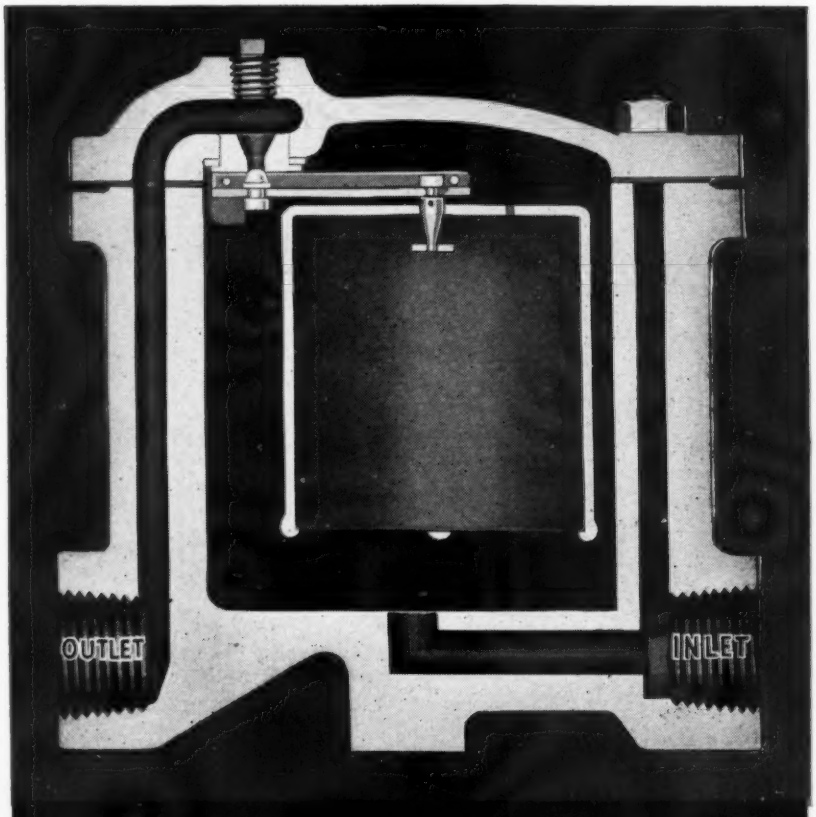
POWER PLANTS . . . cut costs with CLARK STEAM TRAPS. Large volume air removal gives quicker heating up action—saves fuel. Elimination of condensate permits rapid, full flow of new dry, live steam—extends life of equipment.

For 38 YEARS...

fluid controls made by Clark have been saving fuel and increasing equipment efficiency wherever steam, air or gas are used.

Cost Cutters in...

- **Laundry and Dry Cleaning Establishments**
- **Petroleum Refineries**
- **Food Processing and Canning Plants**
- **Meat Packing Plants**
- **Steel Plants**
- **Breweries**
- **Chemical Plants**
- **General Industry**



The popular **CLARK SERIES 70** Inverted Bucket Type Steam Trap with Clark patented Bucket Venting Device and other exclusive Clark features. For general drainage service. Available in 3 sizes: ½", ¾" and 1". For pressures up to 200 P. S. I. and temperatures up to 400° F. Write for free catalog for complete specifications and applications of the wide line of Clark Fluid Controls.

Clark
FLUID CONTROLS

THE CLARK MANUFACTURING COMPANY • DEPT.A • CLEVELAND 14, OHIO

Makers of a wide line of fluid controls including

STEAM AND FLUID TRAPS	STRAINERS	PRESSURE REGULATORS
VACUUM AND LIFTING TRAPS	VALVES	REDUCING VALVES

How Far can you STRETCH a Boiler?

SUPERIOR FEATURES

Automatic Operation — All Superior Steam Generators can be furnished to give fully automatic operation burning any grade of fuel oil including Bunker C. Units can also be furnished to burn natural gas, or with combination gas-oil equipment.

Simple Installation — Shipped completely assembled, your Superior Unit can be operating within 24 hours after it arrives. Mounted on a rigid channel iron base, it needs no foundation other than a level floor capable of supporting its weight. Installation consists only of connecting the unit with water, electric and oil supply lines; steam head to your load; and stack to its outlet.

No Expensive Chimney — The *induced* draft fans are of sufficient capacity to furnish all the air required for maximum rating without need of a chimney other than a vent to carry off combustion gases.

Clean, Quiet Operation — The evenly distributed *induced* draft results in a more quiet operation and eliminates danger of forcing gases into boiler room.

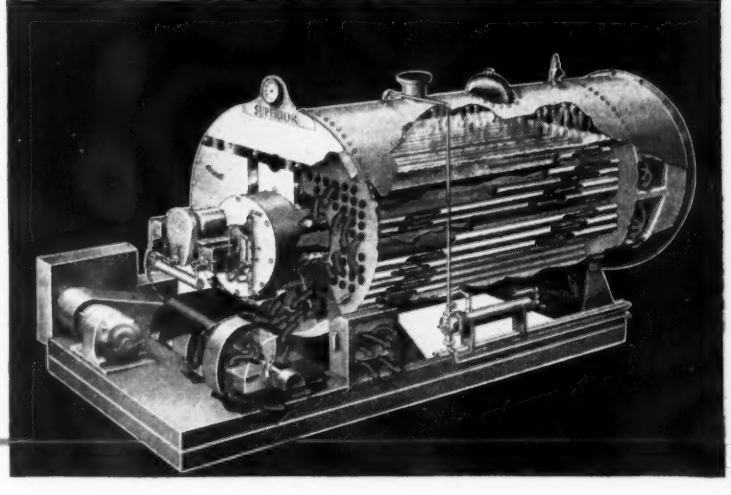
Quality of Steam — The unusually large steam space and the dry pan provided assure dry steam at the nozzle and ample reserve steam capacity. Large evaporating surface promotes quick steaming while preventing surging and foaming prevalent where evaporating surfaces are restricted.

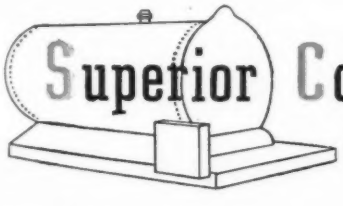
Universally Approved — Built in accordance with and approved by the A.S.M.E., National Board, and the N.E.C. requirements; full insurance inspection and certificate are supplied with each unit. All state and local requirements can be met.

Capacities — Manufactured in 17 sizes from 20 to 500 b.h.p. to operate at pressures from 15 to 200 p.s.i.

If reconversion or obsolete equipment has brought demands for additional boiler capacity, you have probably discovered that there are definite limits to "boiler stretching." The ideal solution to the problems of increased load and loss in pressure is the "packaged" Superior Steam Generator.

If your present equipment is approaching obsolescence, a compact Superior Unit (or a battery installation) will provide the required capacity at higher efficiency. If you need just a little boost, a smaller Superior Steam Generator installed beside present equipment will stretch your plant, assuring ample steam supply. Write for Bulletin 101 today.





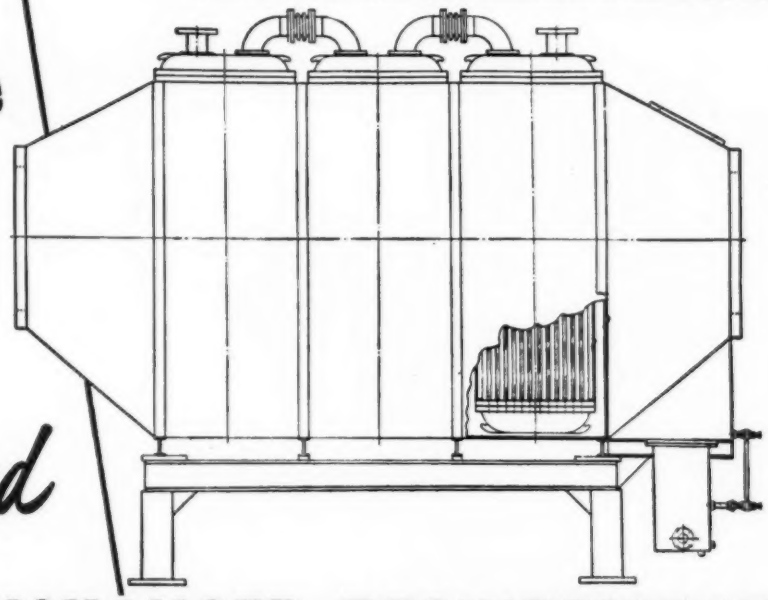
Superior Combustion Industries, inc.

EMMAUS, PA.

Here's another example of Lummus' ability to meet . . .

Specialized

HEAT EXCHANGER REQUIREMENTS



Arrangement of one of four Lummus-designed exhaust-gas aftercoolers. Each has a series of three bundles in a single rectangular shell, providing a total of 12,300 effective square feet of tube surface. Bundles are in vertical position for easy removal by overhead crane to facilitate cleaning, inspection, and maintenance. Each unit is approximately 20 feet long by 16 feet high by 11 feet wide. Conical ends are reduced to 48-inch diameter openings for connection to exhaust piping.

The Lummus Company has built and installed four exhaust-gas aftercoolers for the new altitude-exhaust system for reciprocating and jet engine research facilities of the National Advisory Committee for Aeronautics at the Cleveland, Ohio Airport.

Compressors are used to bring the exhaust gases from simulated stratosphere conditions to atmospheric pressure. The Lummus units cool the exhaust gases to reasonable temperatures for the compressor suctions. Each unit was designed to cool 30,400 lbs. per hour of engine exhaust gas, combined with 7,900 lbs. per hour of water vapor, from 400° to 95°F at 10 inches of mercury absolute pressure.

The units were specially built to meet the exacting conditions of service and to fit the restricted space allotted. Their design permits easy access for inspection and maintenance.

Lummus designs and builds a complete line of heat exchange equipment. For a satisfactory solution to your heat exchange problems, get in touch with The Lummus Company, 420 Lexington Avenue, New York 17, N. Y.

LOOK TO LUMMUS FOR:

Heat Exchangers
Process Condensers
Reboilers
Steam Generators
Steam Jet Refrigeration
Steam Surface Condensers
Barometric Condensers
Steam Jet Air Ejectors
Evaporators
Boiler Blowdown Heat Exchangers
Fuel Oil Heaters
Lubricating Oil Coolers
Pipe Line Coolers
Feed Water Heaters
Jacket Water Coolers

Lummus
HEAT EXCHANGER DIVISION

Here's Where **GULF PARVIS OIL**
Insures improved Lubrication and Lower Maintenance Costs

and Here's Why

GULF PARVIS OIL has higher lubricating value for more effective protection—greater resistance to oxidation for longer lasting protection—and is nonfoaming. These quality features add up to longer bearing life, less cylinder wear, more efficient operation, lower maintenance costs!

The section view above shows two power cylinders in a two-cycle, 3000 H.P. Diesel engine. Here, as in other Diesels with oil-cooled pistons, Gulf Parvis Oil effectively lubricates both cylinders and bearings and cools the pistons—keeps wear to a minimum.

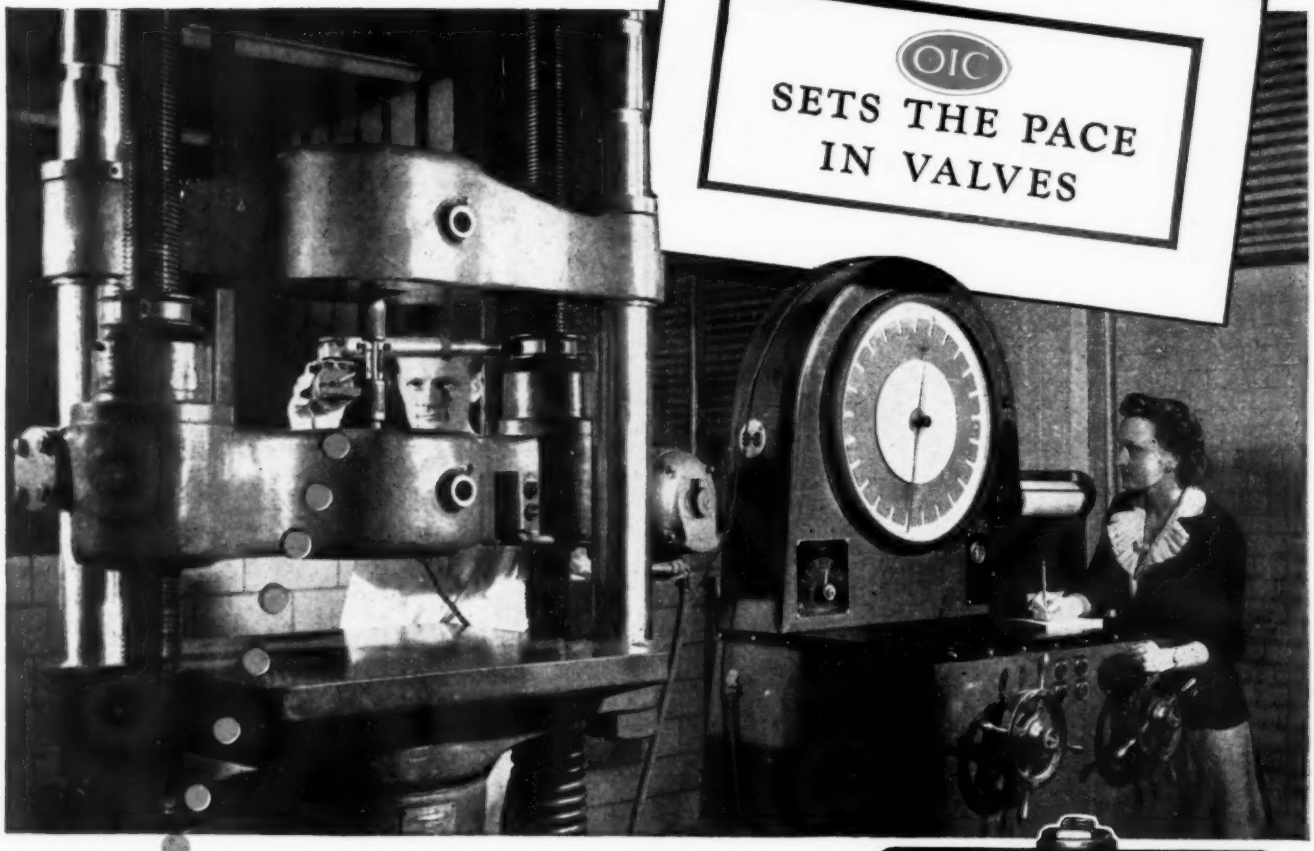
For improved lubrication in your Diesel, call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulf Parvis Oil to meet your particular requirements.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo



OIC
SETS THE PACE
IN VALVES

THEY'RE S-T-R-E-T-C-H-I-N-G YOUR VALVE DOLLAR

"How far will a bar of steel, iron or bronze stretch before it breaks?" That's the $64 question that OIC engineers answer with the huge hydraulic testing machine, pictured above, when they give *every* new run of metal a tough "physical exam." Modern equipment such as this and high standards throughout the up-to-date OIC plant assure you top value, great safety, long service for your valve dollar! You can fit your installations exactly with the many sizes and types of OIC steel, iron and bronze valves. Write for *free* catalog. Just drop a line to The Ohio Injector Company, Wadsworth, Ohio.

SEE YOUR OIC VALVE DISTRIBUTOR

MODERN TEST METHODS are pictured in the new OIC sound slidefilm from which the above photo was taken. See this helpful film to learn more about modern valve construction and usage. *No cost or obligation.* Write today for a showing right in your place of business.

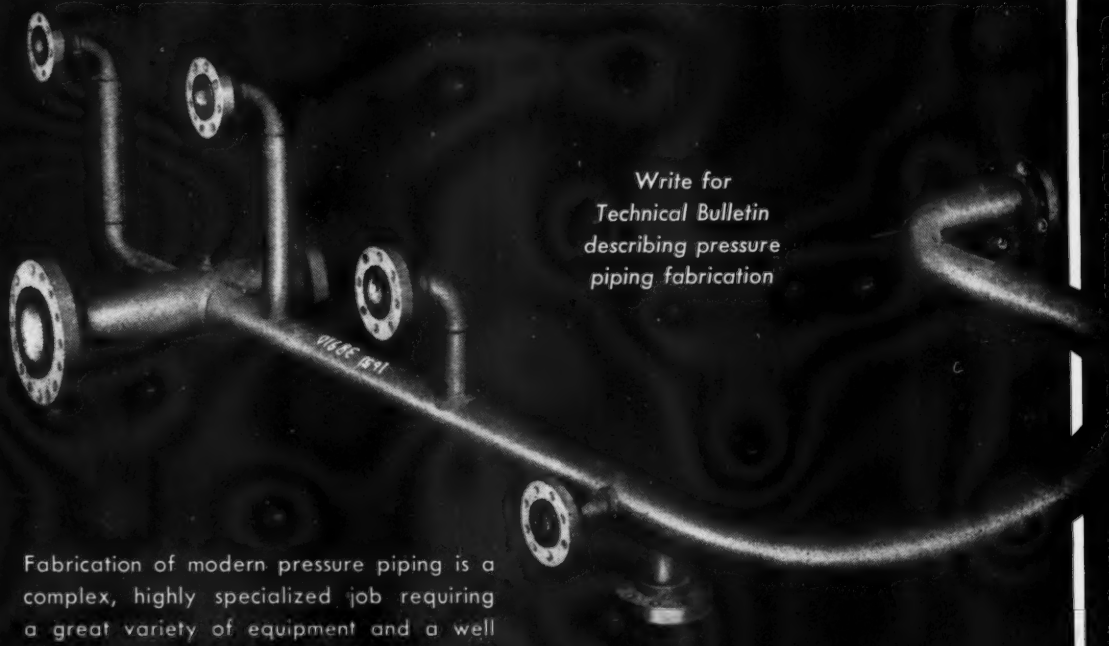
OIC VALVES

STEEL • IRON • BRONZE

0-247-3

modern pressure piping

REQUIRES SPECIALIZED SHOP FACILITIES AND PERSONNEL



Write for Technical Bulletin describing pressure piping fabrication

Fabrication of modern pressure piping is a complex, highly specialized job requiring a great variety of equipment and a well trained, experienced organization.

Qualified pipe fabricators have the advantage of such shops and organizations. Equipment includes layout tables, form cutting machines, work rotating fixtures, bending tables, stress relieving and heat treating furnaces, etc. Experienced staffs work under practically ideal conditions . . . continuously on jobs of similar characteristics that develop exceptional skill and know-how.

Elaborate laboratories and testing facilities constantly check the work of the fabricating staff to assure proper procedures, correct metallurgy and many other factors in quality control.

Pre-fabricated piping made in such shops is of superior quality in every way . . . insuring safety in service. It is delivered to the job in a series of commercially practical sub-assemblies ready for easiest, fastest and most economical erection.

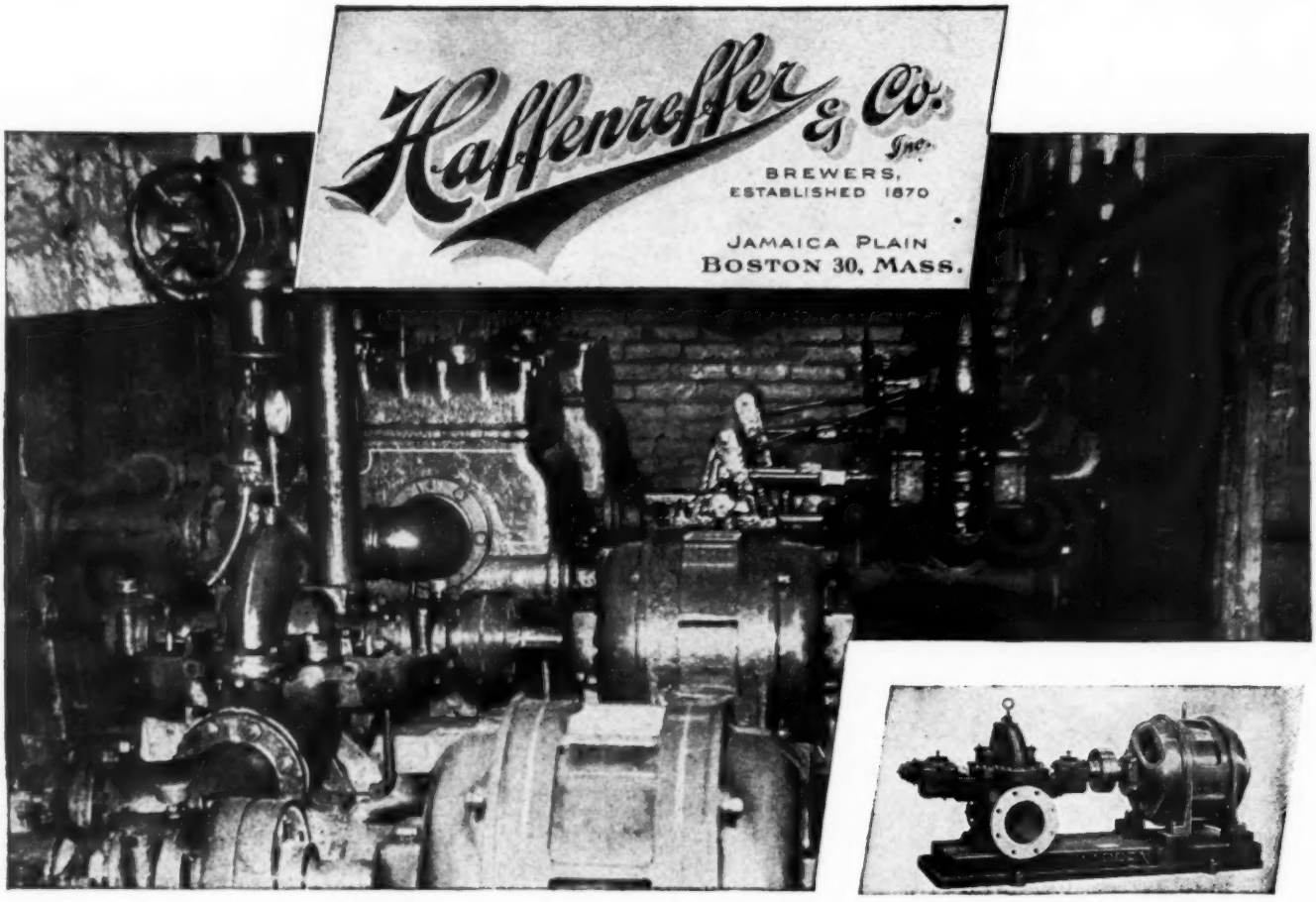
THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1109 CLARK BUILDING **PITTSBURGH, PA.**

3029-1

Another famous user of WARREN PUMPS!

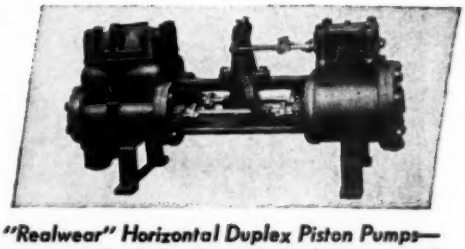


Haffenreffer and Co., brewers in Boston since 1870, depend on Warren Centrifugal and Reciprocating Pumps for efficient, low-cost, long-life pump performance, just as many breweries and widely varied industries have depended on Warren Pumps for the past half century.

For 50 years Warren engineers have designed and built pumps that have solved the pumping problems of hundreds of plants. If you have a pump problem we invite you to write us, letting us have as much detailed information as possible. Our engineers will be glad to make recommendations, with no obligation on your part.

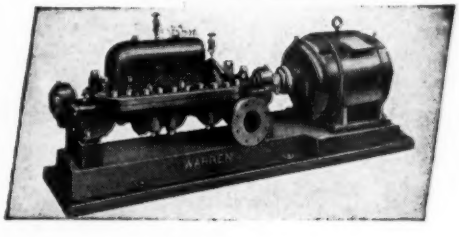
Warren Steam Pump Company, Inc.
WARREN, MASSACHUSETTS P-8

Warren DM and DL, Single Stage, double-suction centrifugal pumps are widely used on various general services. Special metals, capacities, heads, etc., are available to meet various operating conditions.



"Realwear" Horizontal Duplex Piston Pumps—a favorite for boiler feed, fuel oil pressure, oil transfer, general water services, etc. Type TM (below) Four and Six Stage for high pressure requirements in boiler feed, etc.

Write for special bulletins



WARREN PUMPS

ENGINEERING PROGRESS REPORT # 12

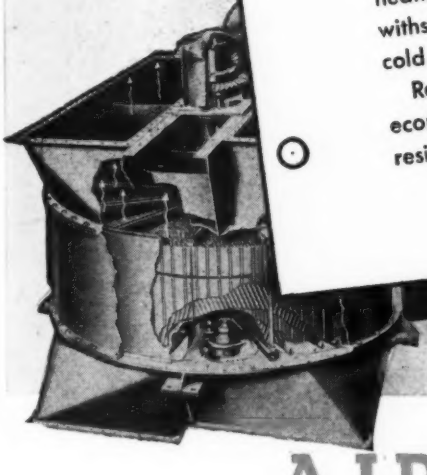
LJUNGSTROM AIR PREHEATER

CORROSION-RESISTANT ALLOY FOR HEATING ELEMENTS

The removable cold end of the Ljungstrom heating element (upper left) and sections from which the cold end has been removed for purposes of illustration.

In the Ljungstrom, the replaceable cold end is made from a special corrosion-resistant alloy that reduces maintenance and replacement. In addition, the heating elements at the cold end are made from heavier gage metal to withstand the impact of the mass soot blower and lengthen the life of the cold end.

Replacement of the cold end of the heating surface is rapid, easy and economical. Standard equipment on all new installations, corrosion-resistant cold ends can be applied to older Ljungstrom air preheaters.



THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

You Can See for Yourself . . .

WHY the Foster 38-SV Safety Valve is ESPECIALLY SUITABLE FOR

HIGH PRESSURES HIGH TEMPERATURES

Pressures up to 3000 pounds and temperatures of 1200° F. are easily handled by the Foster Type 38-SV Super-Jet Safety Valve—it was designed especially for just these exacting requirements! It's no mere "beefed-up" low-pressure valve—rather it's a basic new design for high-pressure service.

Only the Foster 38-SV Safety Valve gives you all these advantages:

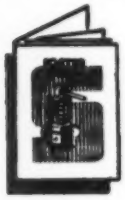
1 . . . ***Exceptional steam economy*** because . . . it reseats as low as 1% below popping pressure . . . reseating is positive; without pounding or chatter . . . blowdown is adjustable from 8% down to 1%.

2 . . . ***Unaffected by temperature changes*** because . . . frame rod construction makes crawl negligible . . . deflector protects spring and rods from escaping steam.

3 . . . ***Maximum protection*** because . . . full opening is practically instantaneous . . . full rated nozzle capacity is available at popping pressure . . . once set under operating conditions, its popping point is constant.

4 . . . ***Positive reseating*** because . . . floating disc design . . . steam-centered piston . . . permanently flat seats.

Specify the Foster 38-SV Super-Jet Safety Valve for the finest in high-pressure protection!



Complete details of the Foster 38-SV Super-Jet Safety Valve, for pressures up to 3000 pounds and temperatures up to 1200° F., are given in Bulletin 25. Write for it today!

FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . AUTOMATIC STOP AND CHECK VALVES . . . ALTITUDE VALVES . . . DAMPER REGULATORS . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . LIQUID LEVEL CONTROLLERS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN AND TRIPLE DUTY VALVES . . . VACUUM REGULATORS OR BREAKERS . . . SIGHT FLOW BOXES . . . STRAINERS . . . SAFETY VALVES . . . SIRENS

106 MONROE STREET • NEWARK 1, N. J.

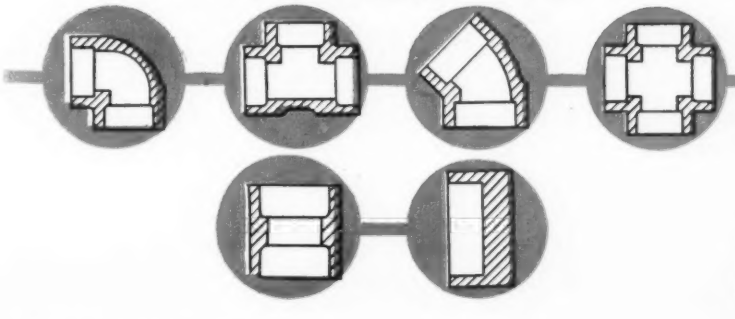
FORGED For Strength Toughness Durability

ACCURATELY CONTROLLED MACHINING ASSURES

Correct alignment · Smooth bore
Uniform wall thickness
Clean sharp threads
Properly proportioned deep sockets

Socket welding fittings available
for use with Schedules 40, 80, 160 and double extra strong pipe.
Screw end fittings available in three classes, 2000 lb., 3000 lb. and 6000 lb.
Each type can be furnished in carbon steel, carbon molybdenum
steel, chromium molybdenum steel, or various
types of stainless steel.

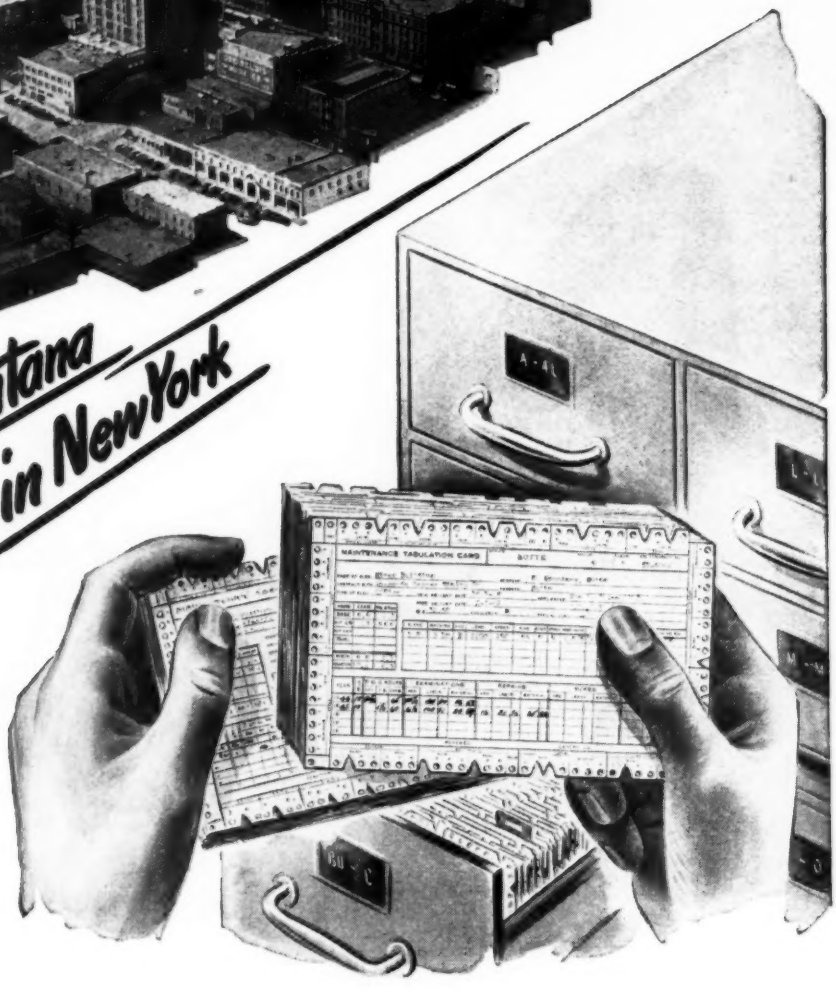
WATSON-STILLMAN CO. • ROSELLE, NEW JERSEY
Sold Through Leading Distributors



WATSON-STILLMAN
DISTRIBUTOR PRODUCTS DIVISION

Photo courtesy Northern Pacific Railway Company.

this is Butte in Montana
this is Butte, Mont. in New York



In Butte, Montana, we are responsible for the complete and constant care of 33 Otis elevators.

At Otis Headquarters in New York, each of these elevators has a card on which its service record is kept up-to-date.

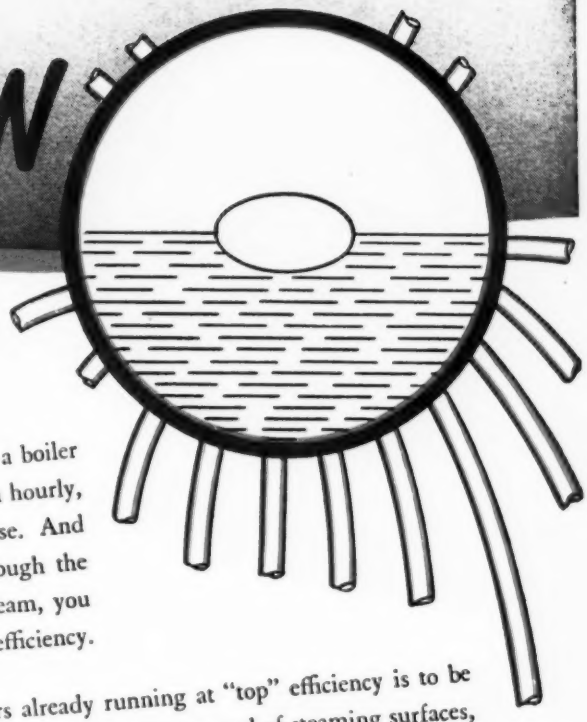
In Butte, local Otis-trained maintenance men inspect the Otis-maintained elevators—regularly cleaning, lubricating, adjusting and repairing them when required.

In New York, Otis-trained analysts regularly study the service records of the Butte elevators. Averaging, comparing and interpreting them against the service records of 30,000 other elevators. Exceptional records are investigated and the knowledge gained is transmitted to Otis maintenance men in 245 local offices.

There is no other maintenance service like Otis Maintenance—anywhere. It can be obtained by 'phoning your local Otis office.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

LINE OF ACTION



FOR GREATER ON-THE-LINE PRODUCTION

When you lengthen the in-service time of a boiler generating many thousands of pounds of steam hourly, you realize a substantial production increase. And when you transmit without needless loss through the metal to the water the heat to make that steam, you approach still nearer to maximum operating efficiency.

Such improved performance from boilers already running at "top" efficiency is to be expected when you charge APEXIOR NUMBER 1 with direct control of steaming surfaces, for APEXIOR adds to water-exposed metal a resistance and endurance not to be found in the best of boiler steel — gives it a surface that's insoluble in natural, evaporated or chemically treated water.

Applied to drums by hand brush and to tubes by Dampney-supplied power coater, APEXIOR NUMBER 1 fills, seals and smooths the surface structure of new or newly cleaned metal, discouraging deposit accumulation and preventing scale-to-metal bonding.

- *That's why an APEXIORized boiler stays on the line longer between inspection and cleaning outages, delivering at highest efficiency from start of run to finish —*
- *why its surfaces remain insulation-free, for better heat transfer —*
- *why it goes back into service faster, at less cost in man-hours of cleaning time.*

Let us tell you how APEXIOR NUMBER 1 can help you better your own best record. Write for Industrial Bulletin to The Dampney Company of America, 1231 River Street, Hyde Park, Boston 36, Massachusetts.

Ask for information also on APEXIOR NUMBER 3, for cold-water-exposed metal, and THUR-MA-LOX High Heat Resistant Coatings, effective to 1600° F.

APEXIOR

THE DAMPNEY COMPANY OF AMERICA
HYDE PARK, BOSTON 36, MASSACHUSETTS
THURMALOX DIVISION, DOYLESTOWN, PENNSYLVANIA

3-46-1

IT COSTS LESS

to Install

ROCKBESTOS

WIRES, CABLES & CORDS

Because They Last

This Type AVA Rockbestos A. V. C. 600 Volt Power Cable and similar types rated up to 5000 volts give trouble-free performance under 230° F. operating temperatures and other severe conditions because:

- The impregnated asbestos braid is resistant to heat, corrosive fumes, moisture, oil, grease and flame.
- The felted asbestos wall beneath the braid won't dry out, crack or flow under high ambient temperatures.
- The moisture resistant high dielectric varnished cambric is protected by two asbestos walls.
- The inner wall of impregnated felted asbestos withstands conductor-heating overloads and won't bake brittle or burn.

One of 125 different wires and cables designed by Rockbestos to meet severe or unusual operating conditions.

A low cost per foot may seem economical when buying wire and cable, but it's the cost *per year of operation* that tells whether you bought a bargain or a maintenance-booster.

That's why wire-wise buyers specify Rockbestos A. V. C. for trouble-making circuits. They know that it gives *extra* years of service and far outlasts other types in 230°F. operating temperatures—that it withstands heating and cooling cycles in conduit—that it won't rot or bloom when exposed to corrosive fumes, grease or oil—and that it doesn't require expensive maintenance.

Service records on hot-spot circuits will show up your hidden costs. Trial installations will convince you that Rockbestos A. V. C. saves money. Select your requirements from our catalog which shows Rockbestos-developed National Electrical Code types and many others in 300 to 5000 volt ratings.

ROCKBESTOS PRODUCTS CORPORATION
182 NICOLL ST., NEW HAVEN 4, CONN.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND PITTSBURGH
DETROIT CHICAGO ST. LOUIS LOS ANGELES
SAN FRANCISCO SEATTLE PORTLAND, ORE.

Three more for the City of Pasadena

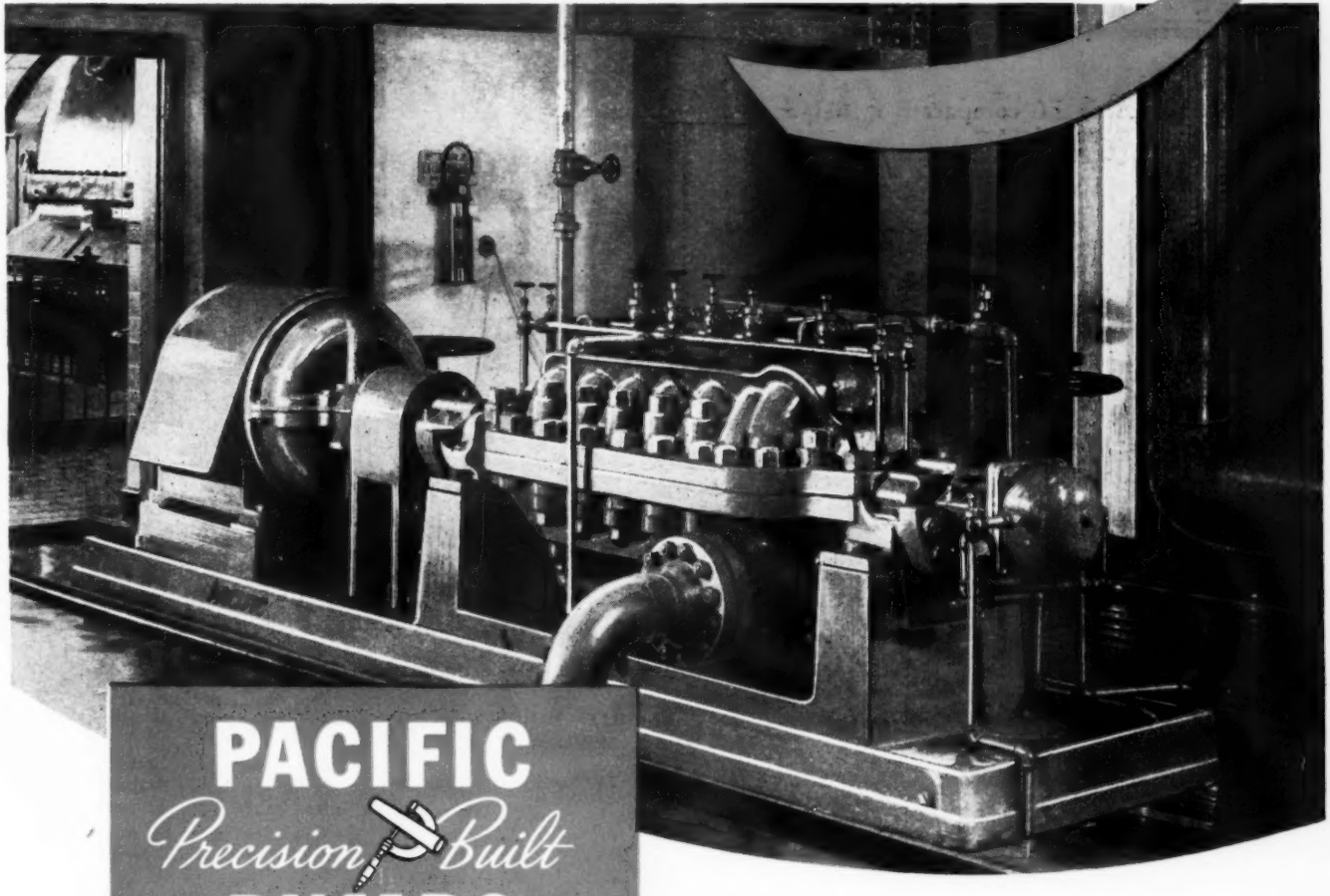
The Dependability of PACIFIC Boiler Feed Pumps

PROVED IN HIGH PRESSURE SERVICE!

Several years ago, the City of Pasadena purchased their first PACIFIC High Pressure Boiler Feed Pump. The performance of this pump was so satisfactory that they recently purchased three more units for 1193 p.s.i.

The dependable performance of PACIFIC Pumps in high temperature, high pressure boiler feed service is the result of balanced design and precision workmanship. Solid head on high pressure end permits use of circular joints, between all points of high differential pressure, preventing interstage leakage and cutting. Dynamic balance of Impellers eliminates pump vibration—minimizing wear. PACIFIC'S exclusive Floating Seal automatically balances axial thrust, prevents Pump from becoming "vapor bound" at reduced capacities, and maintains suction pressure on water-cooled stuffing boxes—reducing packing difficulties.

Write for Bulletin No. 82 for complete information.

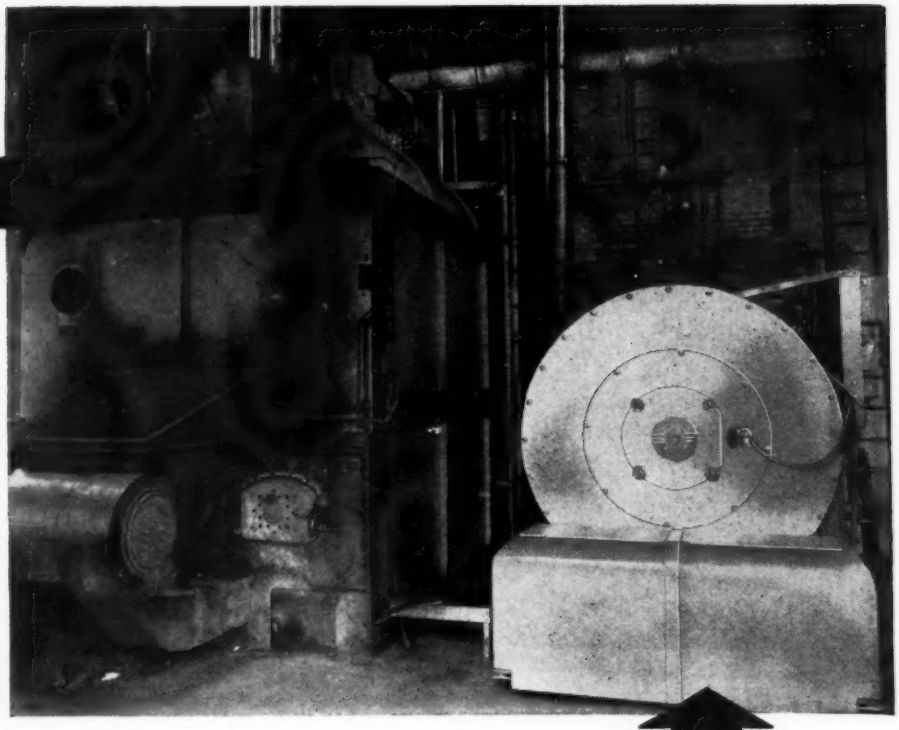


PACIFIC *Precision Built* **PUMPS**

PACIFIC PUMPS, INC.
HUNTINGTON PARK, CALIFORNIA
One of the Dresser Industries

Offices in All Principal Cities—*Export Office:* 122 E. 42nd Street, New York City

THE OLD



. . . and

here's what a

STEAM-PAK

did for Clarence Green

Clarence Green, owner of Green's Dairy in York, Pa., installed this 100 h.p. Model SPH-100-6 *Steam-Pak Generator* in mid-1945.

His records of comparative fuel costs, dried milk production, and savings on labor for two test periods revealed these facts:

USING STOKER-FIRED BOILER (135 days, 1945)	USING STEAM-PAK (160 days, 1945)
Cost of bituminous coal averaged $8.73 per day.	Cost of #6 fuel oil averaged $6.41 per day.
Dried milk production of 29,108 lbs. for the period.	Dried milk production of 45,291 lbs. for the period.
Normal cost of labor for firing and residue removal.	Estimated savings of $2,000 per year on labor costs.

STEAM-PAK YORK HEAT GENERATOR

THE NEW

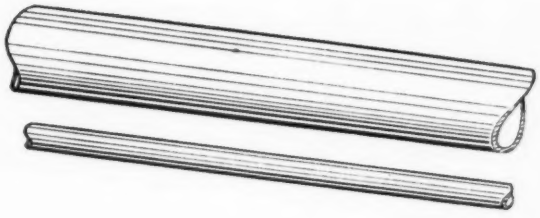
priceless quality precision combustion

High pressure *Steam-Pak Generators* are the ideal units wherever process steam is required. Request Catalog ID-47-8F for the sales story . . . Catalog ID-46-1F for "Facts and Figures." Industrial Division, York-Shipley, Inc., York, Pa.

YORK-SHIPLEY

Oil-Fired Equipment for Industry

AMERICA'S MOST COMPLETE LINE

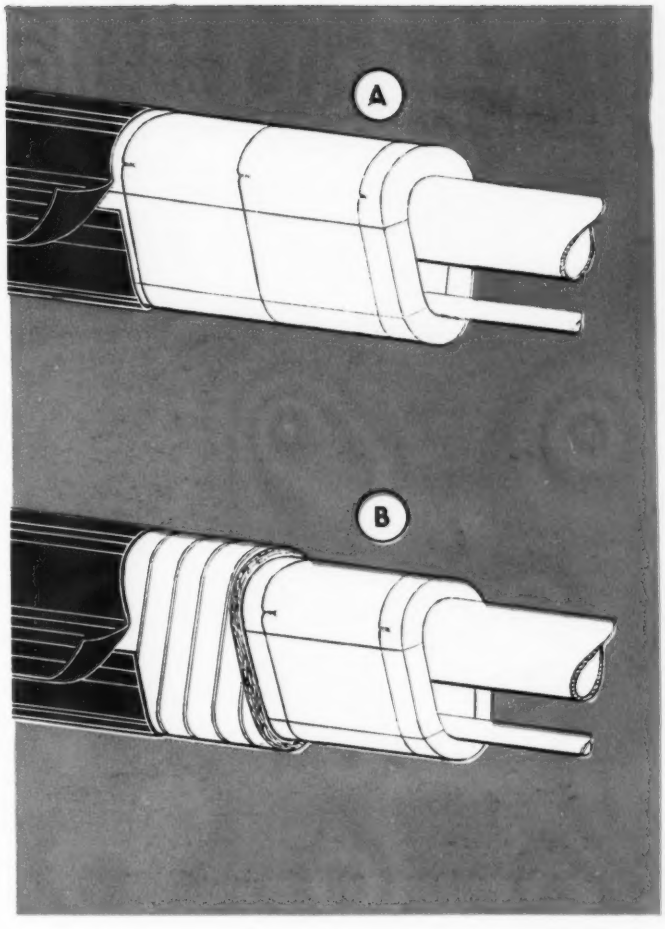


How would YOU insulate these lines?

Here's the problem: A 4" line carrying a high-viscosity processing oil at 130° F. runs overhead from a heated outdoor storage tank across a factory yard to the processing operation. 1½" below it runs a 1" tracer line carrying saturated steam at approximately 15 lbs. pressure (250° F). The plant is located in the Great Lakes region. How would you insulate these lines?

A ☐ Half section of 85% Magnesia pipe covering on top of oil line and another on bottom of steam line. Join the pipe covering with 85% Magnesia block on both sides. All 85% Magnesia to be 1½" thick. Point up joints with asbestos cement and weatherproof.

B ☐ Cover with 85% Magnesia as above, but use standard thickness. Then apply one layer of 1" hair felt and weatherproof.



Here's what the Armstrong engineer advised:

The problem is to maintain the viscosity of the process oil regardless of outside temperatures with a minimum use of steam. Therefore, the insulation must surround both pipes in such a manner that heat can be transferred from the steam line to the oil line. The installation is comparatively permanent and should serve for many years.

Both methods shown are efficient and lasting. Under average service conditions, when winter temperatures do not drop below zero for any appreciable length of time, method (a) will prove entirely satisfactory. But in localities where sub-zero winter temperatures are common, extra precautions have to be taken to guard against thickening of the oil in a line. That's why the Armstrong engineer recommended method (b) for the job in the Great Lakes region. He knew that, while somewhat higher in original cost, extra insulating efficiency furnished by the one inch layer of hair felt would provide inexpensive insurance against production difficulties if the oil congealed in the line in extremely cold weather.

Sometimes it is possible for Armstrong engineers to point out sound methods of heat insulation that give you immediate savings. In other cases, such as this one, their thorough training and long experience indicate that it is better to spend a little more now in order to save larger sums in the long run. When you call in Armstrong's Contract Service—for a bid, for a complete job, or just for informal advice—you can count on getting recommendations that will genuinely serve *your* interest.

Free! New Insulation Chart

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write for your copy today to Armstrong Cork Company, Industrial Insulation Dept., 7003 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

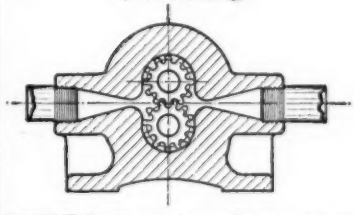
NEW *Series "K"* ROPER ROTARY PUMPS

HUB, FLANGE, OR FOOT MOUNTED FOR BELT, CHAIN, OR DIRECT DRIVE

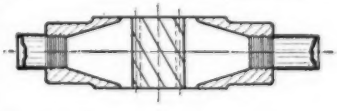
Embodying the new Roper venturi suction and discharge principle, the new Series "K" pumps are rugged, compact units that save space and reduce power costs. Liquid to the pumping gears is properly accelerated, then decelerated, improving operating efficiency and the ability of the gears to handle a wide range of viscous liquids at standard motor speeds without changing pump size to avoid cavitation and noise. Roper pumps have a high suction lift . . . are unusually quiet and operate efficiently in either direction.

They are precision built, self-lubricated by the liquid pumped, and adaptable to a wide range of jobs . . . pressure lubrication, hydraulic service, fuel supply or transfer work pumping clean liquids. Equipped with mechanical seal or packed box, with or without relief valve. May be direct connected, belt or chain driven. Interchangeable mounting brackets and adapters . . . provisions for either hub, flange, or foot mountings.

NEW VENTURI SUCTION AND DISCHARGE PRINCIPLE
(Patent Pending)



WHAT IT IS: An entirely new design application giving results unachieved with conventional pump designs. From the outside of the case the two ports are elongated, tapered openings extending to and across the full center area of the gear bores. It is a proportional means by which liquid velocity is kept in step with the velocity of the pumping gears.



WHAT IT DOES: Causes the liquid to pass through the pump with a minimum of energy loss from turbulence, friction, and cavitation. Provides a uniform distribution of liquid across the gear face increasing efficiency by reducing recirculation losses. Adds quietness and reduces power cost. Provides the means for handling a wider range of viscous liquids at standard motor speeds.

ROPER *Rotary Pumps*

Get all of the Facts

Send For Free Folder

Complete details, including: specifications, exploded view of construction features, and wide range of mounting conditions, will convince you that Roper Series "K" Pumps insure a fast, dependable solution to pump application problems.

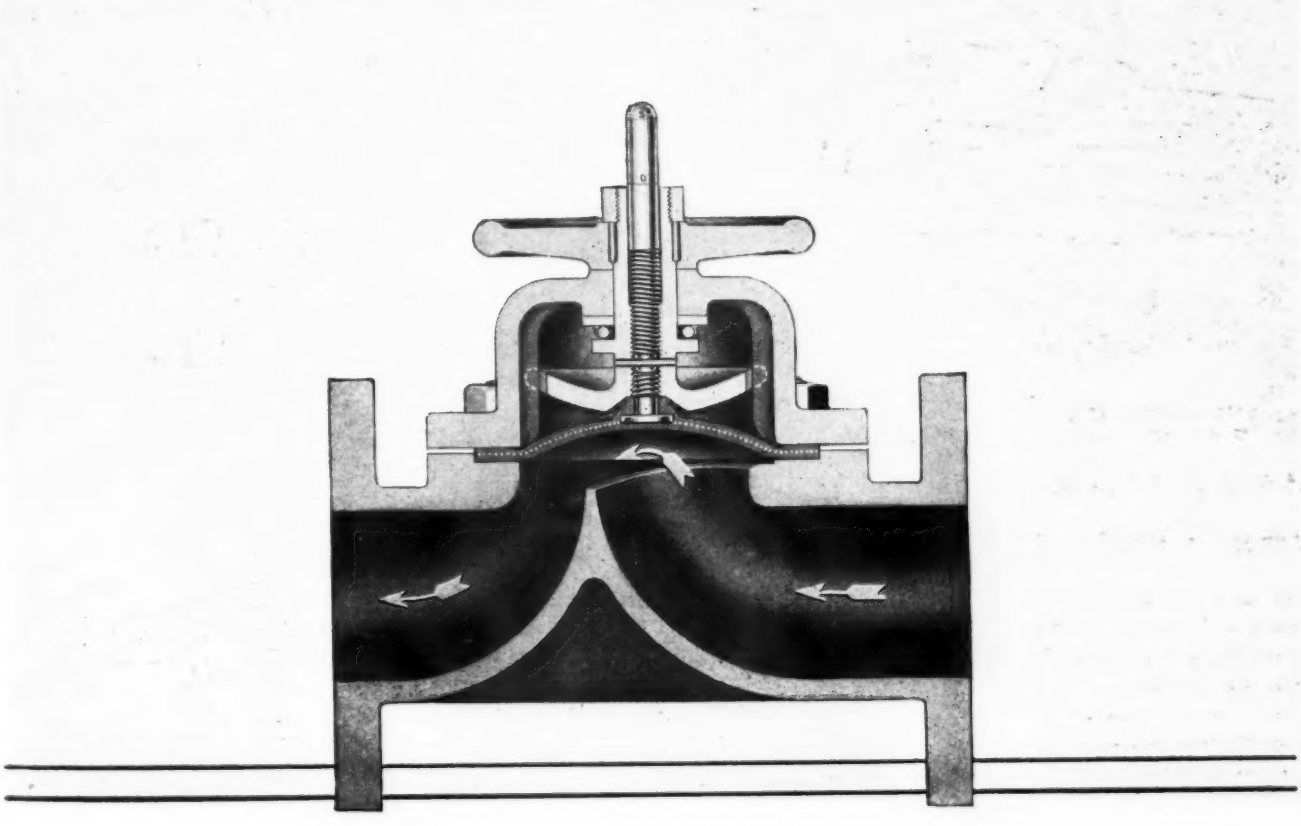
SEE OUR CATALOG IN SWEET'S

Other Models up to 300 G.P.M., Pressures up to 1000 P.S.I.

GEO. D. ROPER CORPORATION, 353 BLACKHAWK PARK AVE., ROCKFORD, ILL.

NOW...A VALVE THAT LAUGHS AT CORROSIVES AND ABRASIVES

...and cannot LEAK, "FREEZE" or JAM!



McAlear No. M-1455 Diaphragm Valve

★ *Pressures, Vacuum to 150 lbs.* ★ *Temperatures to 150° F.* ★ *Sizes ½" to 6".*

- Applicable for air and water lines and special services.
- Used in *every* industry that handles corrosive or abrasive fluids.
- Diaphragm separates mechanism *completely* from fluids handled.
- Shut-off positive—even with solids trapped on seat.
- Closure not dependent on metal-to-metal contact.
- Cannot leak in any position.
- Requires no re-packing.
- Requires no re-seating.
- Diaphragm replaceable with valve in line.
- Special pressure operated types for automatic or pilot control.

FOR BULLETIN giving complete data, write McAlear Manufacturing Company, Automatic Control Division of Climax Industries, 1913 S. Western Ave., Chicago 8, Illinois.

CLIMAX INDUSTRIES

McALEAR

PRESSURE FLOW LIQUID LEVEL TEMPERATURE

controls

for STEAM, WATER, AIR, OIL—GAS

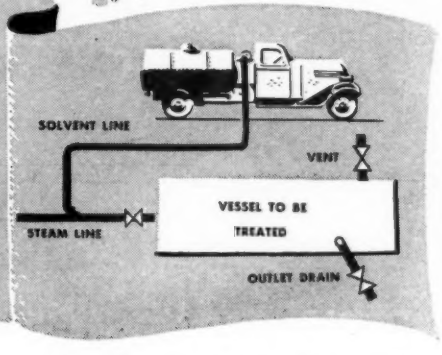
THE EVOLUTION OF "Ed Engineer"

A 6-ACT THRILLER

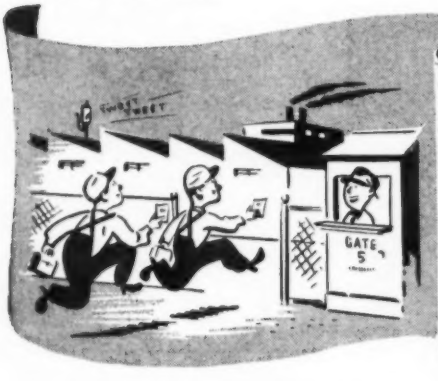
A LESSON IN INDUSTRIAL SCALE REMOVAL

Ed Engineer was a bug about newfangled ideas, but a stickler for efficiency, too. When Sam, the ICI man, told him about the easy, modern way to remove scales and sludges from industrial equipment, he was willing to listen, but he was still skeptical. After all, cleaning scales and sludges from industrial equipment is not easy.

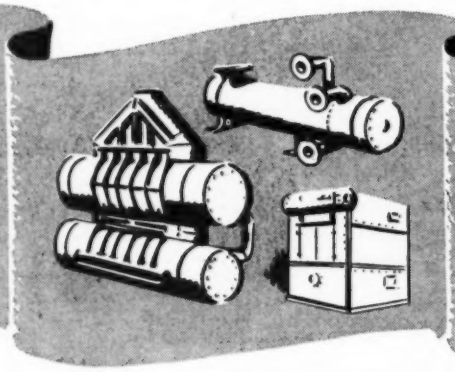
Young Sam Salesman explained how ICI makes a complete analysis to determine exact type of scale and how sometimes this includes both tests of chemical solubility and X-Ray examination for identification of complex substances. From these tests, he explained, ICI determines the proper solvents for removing these substances.



And when it comes to efficiency, take ICI's mobile equipment — special stuff manned by special crews. These dependable units, handled by experienced ICI technicians, pump chemical solvents into the units being cleaned. These solvents penetrate wherever water can flow, so that all interior surfaces are thoroughly cleaned.



By using the ICI method you can reduce your cleaning time, and return your equipment to service in a matter of hours. Heat transfer units are quickly restored to original efficiency. No dismantling or disassembly is necessary. Time off the line is reduced and the inconvenience of manual cleaning is eliminated.



ICI methods and equipment have no limitations. They work equally well on boilers, exchangers, water filters, condensers, blast furnaces, water lines, economizers, and all other similar equipment with the same characteristics. Best of all, ICI methods cause operating efficiency to go up while cleaning costs go down.

Well, said Ed Engineer, go ahead! Clean up my equipment, but remember, I'm checking this job — I expect less down time, no disturbance, lower fuel costs and, above all, that every surface area — curved, plane, or tubular — will be clean.

P.S.: Ed got all he asked for and more. Why don't you get curious, too? — It will pay.

Licensed under processes practiced by Dowell, Incorporated, a subsidiary of the Dow Chemical Company.

CHEMICAL SERVICE DEPARTMENT

INTERNATIONAL CEMENTERS, INC.

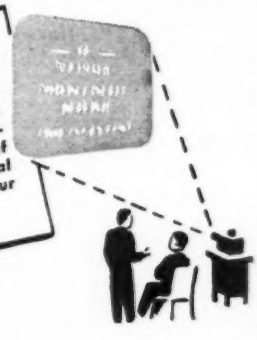
LONG BEACH, CALIFORNIA

SERVICE OFFICES:

Long Beach, California . . Tel. 48591
Oakland, California . Tel. Higate 6168
Bakersfield, California . . Tel. 30255
Casper, Wyoming . . . . . Tel. 972

AVAILABLE NOW!

Take advantage of this new 18-minute 35 mm. slide film with sound "More Power to America's Industry" — illustrating the possibilities of ICI's Chemical Scale Removal Service. Call or write your ICI man today.



For quick response, precise control . . . of Boiler Draft Fans

Investigate

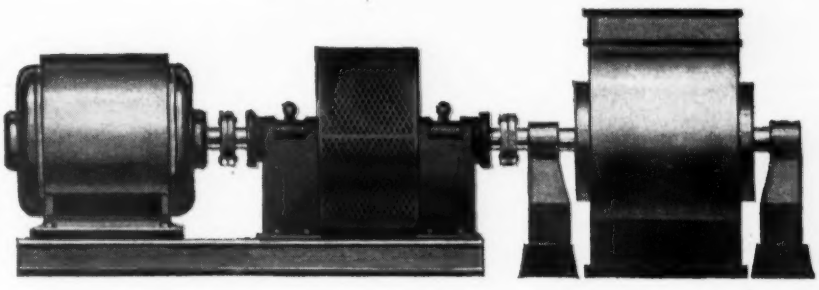
E-M Magnetic Drive

WIDE speed range . . . precise control . . . quick response . . . lower power consumption . . . longer fan life . . . any one of these advantages provides more efficient boiler draft fan operation. *All* these features—and more—are characteristics of the E-M adjustable speed Magnetic Drive.

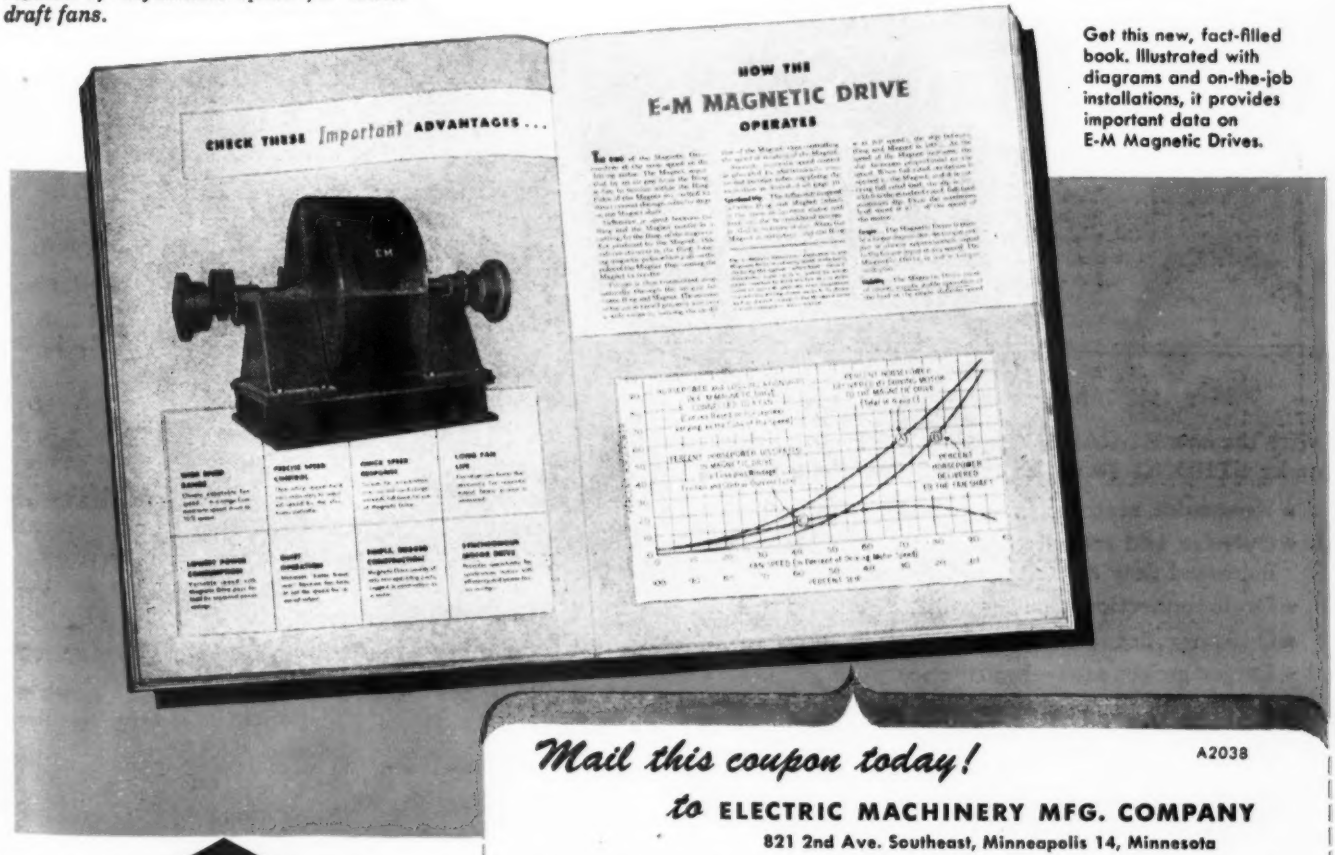
With the simple, economical Magnetic Drive, you have a dependable fan control method already proved superior on hundreds of diversified jobs. Backed by E-M's half-century of experience in manufacturing large electric motors and generators, the Magnetic Drive has gained wide acceptance in modern steam plants.

The rugged Magnetic Drive is a compact, self-contained unit placed between the motor and fan. Torque is transmitted electro-magnetically. The Magnetic Drive requires no fluid and is self-cooling.

The E-M Magnetic Drive is the modern method of adjustable speed for boiler draft fans.



A constant-speed motor drives the ring. The magnet rotates within the ring. Magnet speed is controlled electronically by adjusting excitation to magnet poles. The magnet drives the load.



Get this new, fact-filled book. Illustrated with diagrams and on-the-job installations, it provides important data on E-M Magnetic Drives.

Mail this coupon today! A2038

to **ELECTRIC MACHINERY MFG. COMPANY**
821 2nd Ave. Southeast, Minneapolis 14, Minnesota

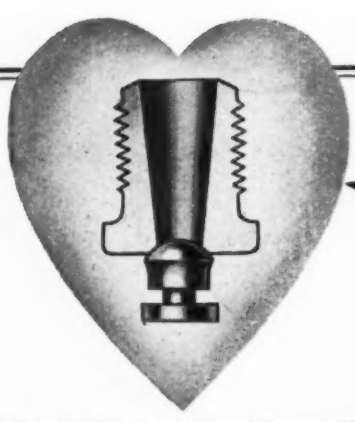
Please send me your Free Booklet No. 183 "The E-M Adjustable Speed Magnetic Drive".

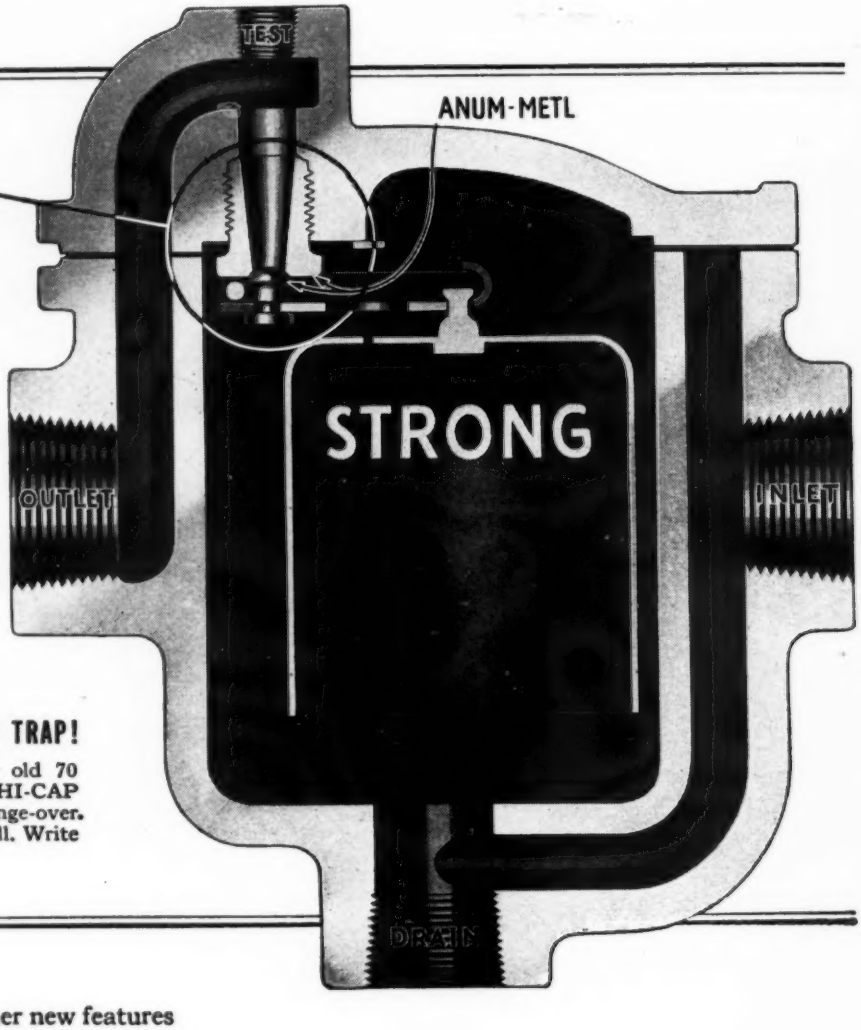
Name_____ Company_____

Address_____

City_____ Zone_____ State_____

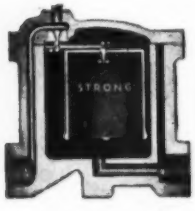
New Heart* gives STRONG Traps up to *25% Greater Capacity!*





HI-CAP* Orifice—the "heart" of the IMPROVED STRONG Trap!

The new Strong HI-CAP orifice with ANUM-METL valve and seat is a scientifically designed throat which permits maximum discharge with minimum turbulence and choking effect of flash steam.



CONVERT YOUR OLD TRAP!

You can convert your old 70 Series traps to *new* HI-CAP traps by ordering a change-over assembly. Easy to install. Write for details.

With the new HI-CAP orifice, these other new features make STRONG 70 Series traps better than ever:

- ★ Renewable seat replacing pressed-in design;
- ★ Oversize and relocated inlet and outlet ports—increased flow capacity, avoids backflow;
- ★ Drain connection added—available for bottom inlet;
- ★ One-piece, deep-drawn, stainless bucket—no welds;
- ★ Larger gasket area—positive seal;
- ★ Improved, stainless, high-ratio leverage.

With a complete line of Strong open and inverted bucket traps, our engineers can specify exactly the *right* type for your particular application. Write for our HI-CAP Bulletin for complete details on the new HI-CAP traps.

STRONG, CARLISLE & HAMMOND COMPANY

1392 West 3rd Street • Cleveland 13, Ohio

*HI-CAP, Trade Mark Registered

REG. TRADE MARK

OTHER ANUM-METL Reg. Trade Mark

STRONG

STEAM SPECIALTIES

Reducing Valve

Strainer

No. 80 Series Trap

MIGHTY
FOR A MIGHTY JOB

THIS "Buffalo" SINTERING FAN

One of the toughest air handling jobs in Industry is performed by this Buffalo Sintering Fan.

The Sintering Process recovers iron ore dust in steel-making. The fan is used to supply high-pressure, high-temperature dust-laden air to a combustion chamber, where the ore dust is turned into a slag which can be recovered. Supplying air continuously against high pressure, this fan is subjected to the abrasive action of gritty ore particles, and temperatures up to 400°F.

Probably you will never consider the purchase of a Sintering Fan, for there are not many such applications in the entire country.

However, the engineering experience and the factory "know-how" which makes "Buffalo" the logical choice for such "extreme-service" jobs is also available to you on your everyday air-moving and conditioning work. "Buffalo" builds complete lines of ventilating fans, both centrifugal and axial flow, power plant fans, industrial blowers and exhausters for every service, and complete lines of air conditioning cabinets, central systems and unit coolers.

Write us for Bulletins.

BUFFALO FORGE COMPANY

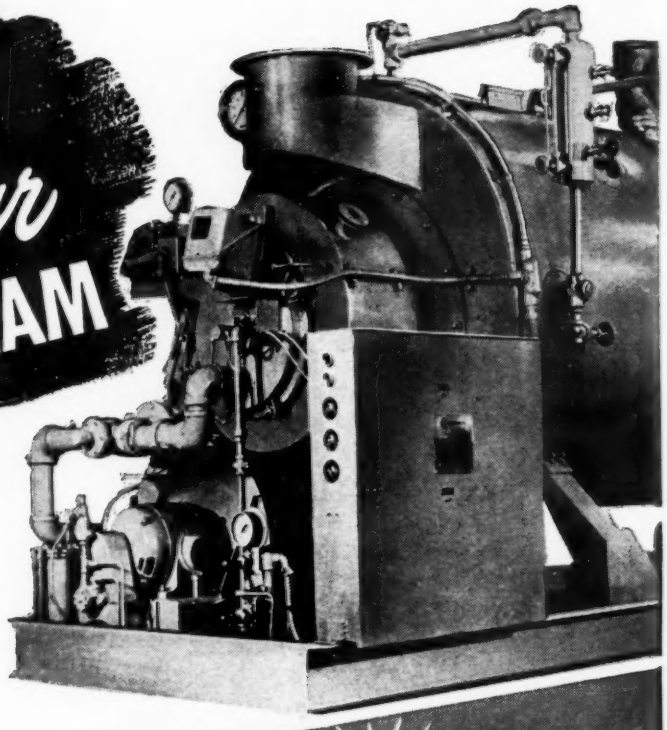
488 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

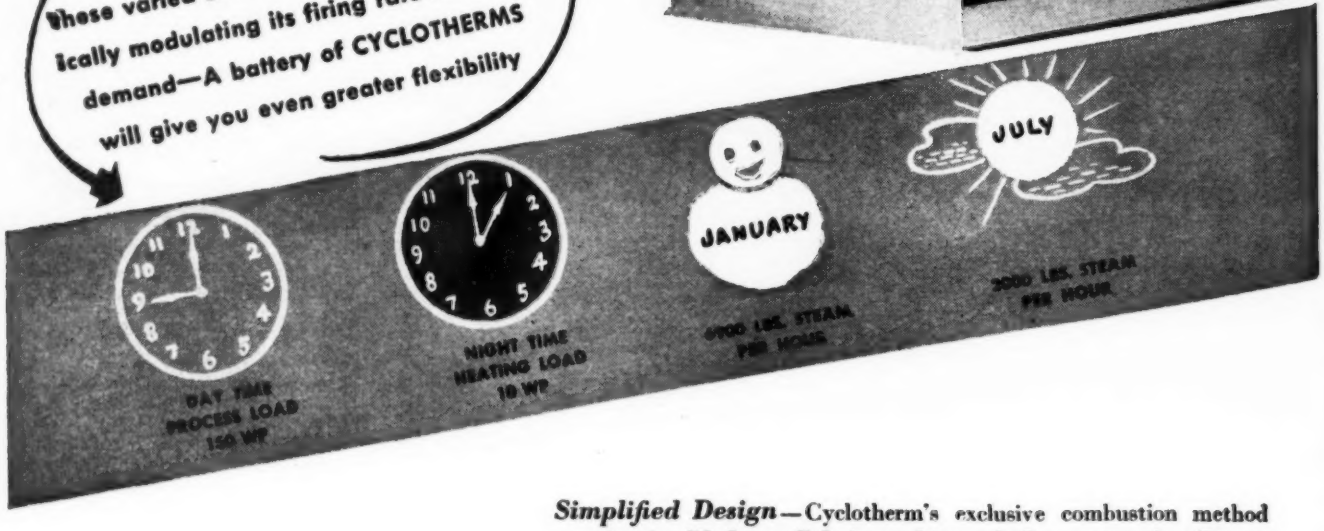
Note the husky construction of this Buffalo Sintering Fan, under construction in the plant.

"Buffalo" **FANS for INDUSTRY**

CYCLOTHERM will meet your TIME-TABLE for STEAM



A single CYCLOTHERM will meet these varied steam demands—automatically modulating its firing rate to steam demand—A battery of CYCLOTHERMS will give you even greater flexibility



Compare THESE FEATURES THAT MAKE CYCLOTHERM your best buy!

Simplified Design—Cyclotherm's exclusive combustion method permits simplified overall design and 2 pass boiler construction. Burner and boiler engineered as an integral unit.

Performance—Cyclotherm provides steam automatically as you need it. Overall thermal efficiency will be not less than 80%.

Economy of Operation—Cyclotherm units may be fired with any liquid or gaseous fuel with maximum efficiency. Automatic modulation of flame on units 50 HP and up.

Low Upkeep—Unique combustion principle with 2 pass boiler assures longer life, fewer and easier inspections and "clean-outs."

Initial Cost—Cyclotherm units are low in cost; easy and inexpensive to install. Delivered ready to produce steam; require no special foundation.

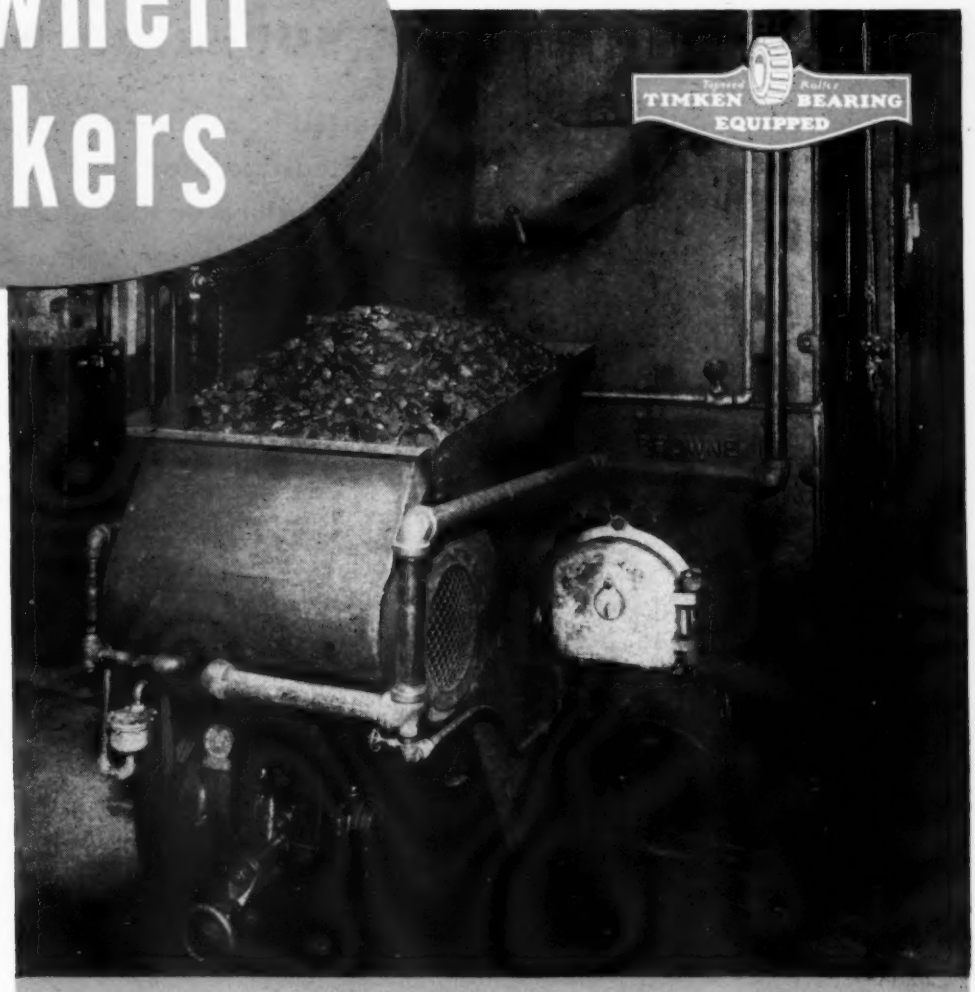
Phone, wire or write for full information

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 802, NEW YORK 4, N. Y.

Brownell Stokers

Brownell Low Ram Type Stoker equipped with Timken Bearings. Electric Unit Drive with constant speed motor.



use Timken Bearings

Timken Tapered Roller Bearings are important factors of efficient, dependable and economical performance in mechanical stokers of all types — have been for years.

They are used on the high speed and intermediate shafts of Brownell Ram Type Stokers to protect these vital rotating parts against friction; wear; radial, thrust and combined loads; and danger of misalignment. Thus they promote smoother operation, reduce power demands, increase endurance, cut maintenance.

Keep steam up — keep fuel cost down with Timken Bearing Equipped stokers. Look for the trade-mark "TIMKEN" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

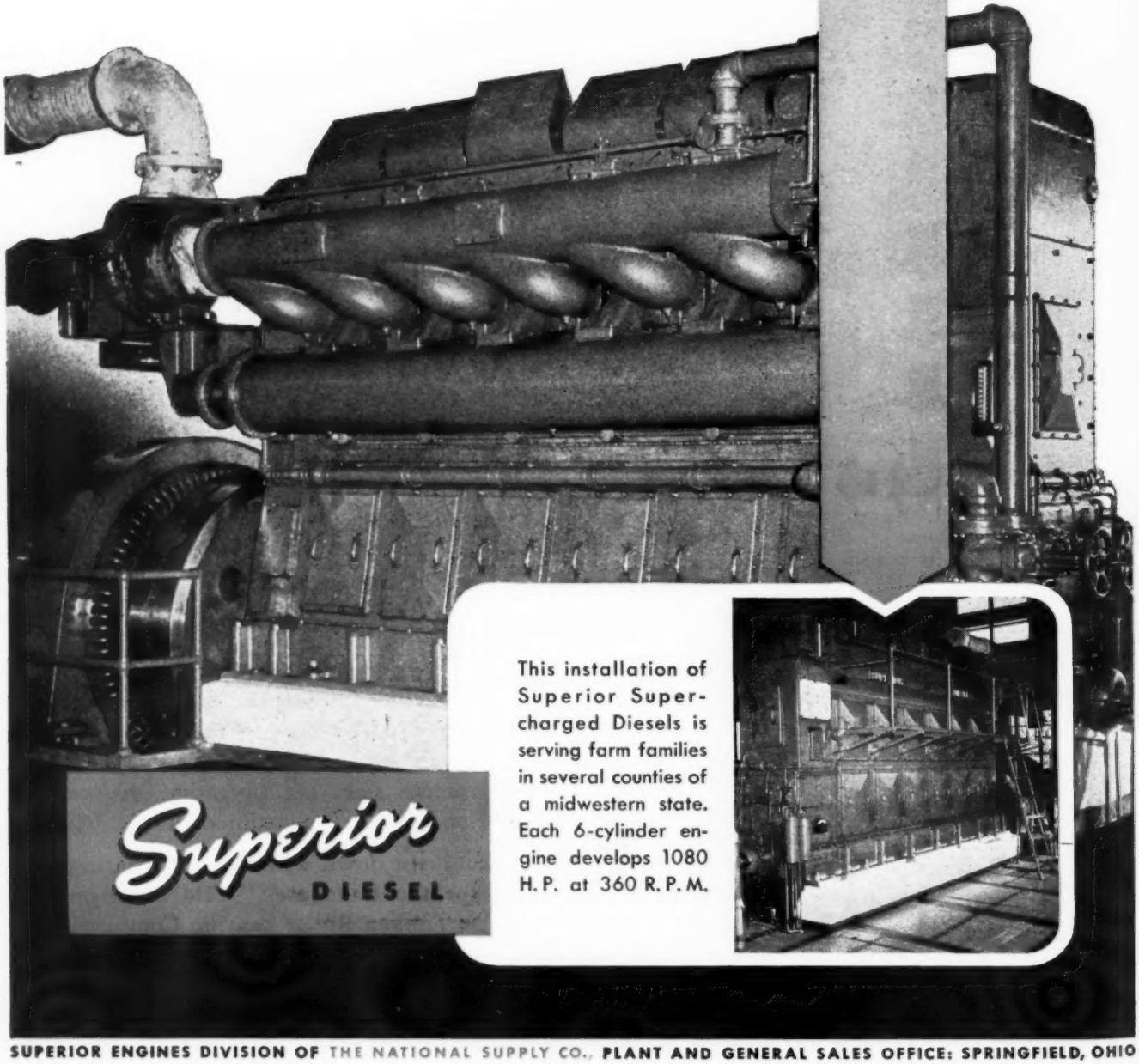
TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST —◎— LOADS OR ANY COMBINATION ✳

FOR *Sure Starts*

BUY A SUPERIOR DIESEL ENGINE

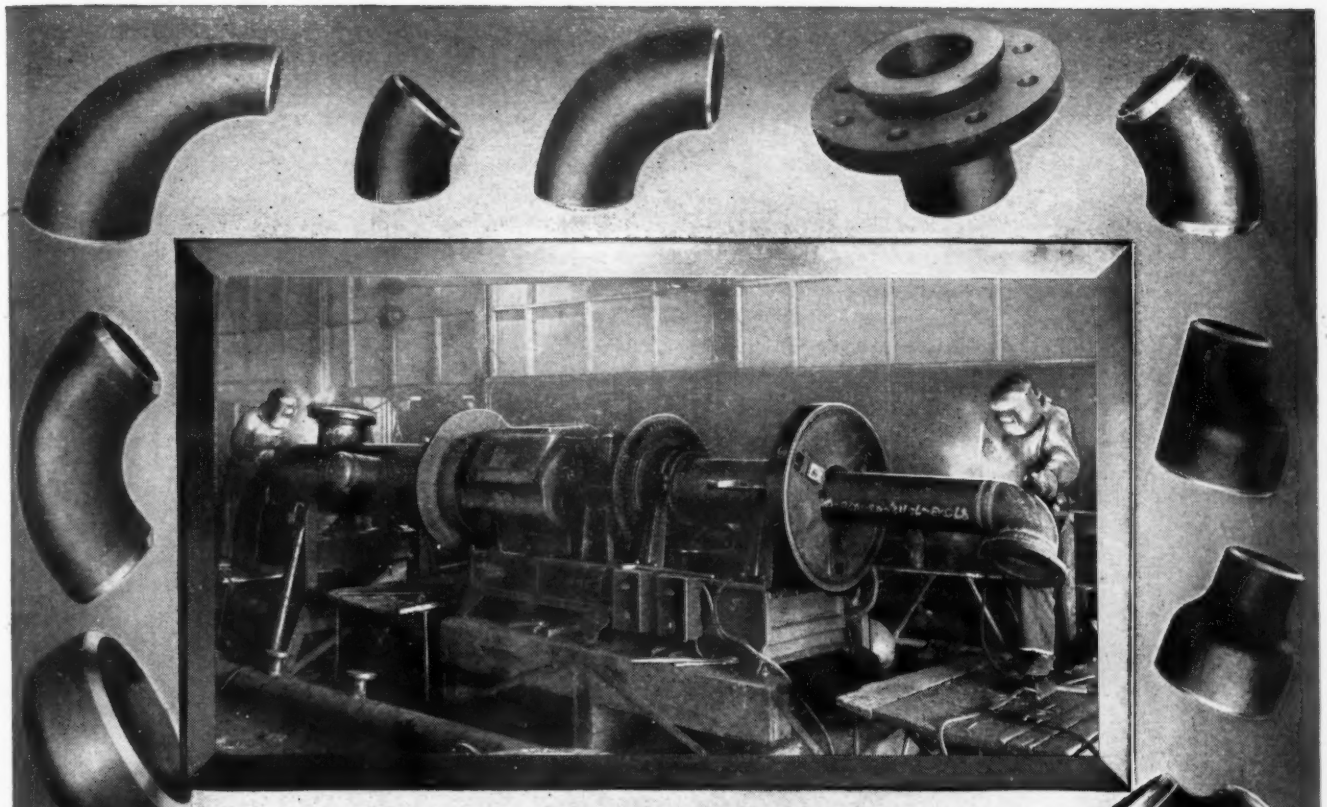
Superior Diesels are started easily by compressed air—the dependable system universally accepted and used by the Diesel industry for many years. The distinguishing feature of the Superior system is the use of an air starting valve for each cylinder, with overlapping timing so that one or more cylinders will always be receiving starting air while in a turning position, which eliminates dead centering. Admission of starting air to all cylinders, combined with effective fuel spray and proper compression ratio, results in quick engine turnover and rapid firing.



Superior DIESEL

This installation of Superior Supercharged Diesels is serving farm families in several counties of a midwestern state. Each 6-cylinder engine develops 1080 H.P. at 360 R.P.M.

SUPERIOR ENGINES DIVISION OF THE NATIONAL SUPPLY CO., PLANT AND GENERAL SALES OFFICE: SPRINGFIELD, OHIO



"As One User to Another"

MIDWEST Talks About PIPE WELDING FITTINGS

When you buy Midwest Welding Fittings, you get the same fittings that we use by the thousands in our own shop fabrication and field erection. So we can talk about pipe welding fittings "as one user to another."

We *know* that Midwest Welding Fittings save time in prefabricating piping . . . and in erecting piping in the field. Their sound design, dimensional accuracy and uniformity are features which are of definite help in making the job easier . . . in saving time and money . . . in providing better piping.

We *know* that the large variety of Midwest Fittings is another time and money saver . . . in addition to improving piping practice. We have reference to such Midwest developments as reducing elbows, "long tangent" elbows, shaped nipples, etc. See Bulletin WF-41 for complete information.

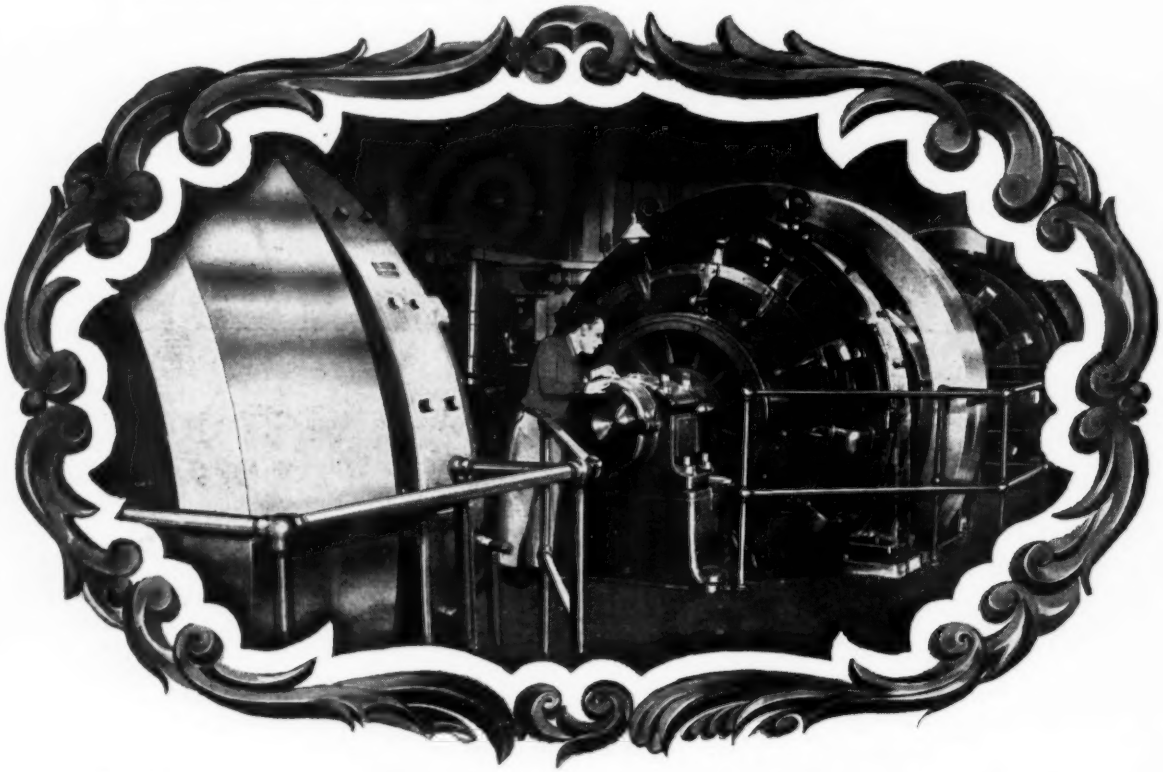
MIDWEST PIPING & SUPPLY Co., Inc.

Main Offices: 1450 South Second Street, St. Louis 4, Mo.

Sales Offices: New York 7—30 Church St. • Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities

We're Looking for the Oldest Burke-Motor or Generator in Active Service Today

SINCE 1891 we've built hundreds of large Burke Motors and Generators and because all of us at Burke take pride in building well, our Quarter-Century Club at Burke expressed a desire to recognize in some fitting manner the oldest Burke Motor, 200 HP and larger, or Generator, 150 Kw. and larger, in active service today. We are writing to old users but thought, that this message in the trade papers, would locate our champion immediately. Drop us a line about your old Burke Motor or Generator and a photo if available and give us the name of the man or men largely responsible for the good service.

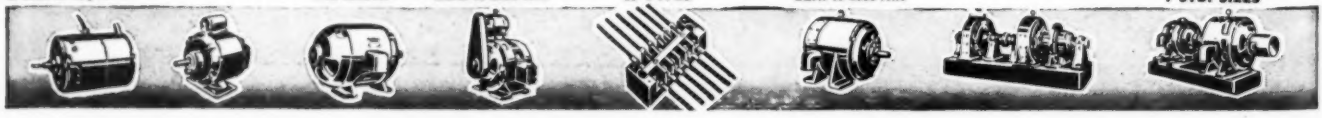


A. J. Kenning, CHIEF ENGINEER of the BENJAMIN FRANKLIN HOTEL of PHILADELPHIA presents the 22 year old Burke Generators under his care as follows: "The three Burke Generators we installed twenty-two (22) years ago are giving us the same satisfactory service today as they did when first installed. They are coupled to Erie Ball Engines. Number one generator commutator was turned down seven years ago, Number 2 and 3 have never been turned down. We have installed four sets of brushes on each generator, otherwise we never spent any money in twenty-two years on these generators. They are in the best of running condition".

Write for condensed catalog of Burke products

BURKE ELECTRIC COMPANY 273 W. 12th ST. ERIE, PA.

UNIVERSAL MOTORS 1/50th to 2½ HP	SINGLE PHASE MOTORS to ¼ HP	INDUCTION MOTORS 1 to 1500 HP	SYNCHRONOUS MOTORS to 1500 HP GEN. to 1000 Kw.	TERMINAL BLOCKS 10 TYPES	D.C. MOTORS to 1500 HP GEN. to 1000 Kw.	M-G SETS to 1000 Kw.	HIGH CYCLE M-G SETS— 7 STD. SIZES



PRECISE CONTROL
OF WELDING PROCEDURES

AVAILABLE ONLY THROUGH MODERN SHOP FABRICATION

PRECISE welding control is a major reason why shop fabrication by Pittsburgh Piping and Equipment Company results in a thoroughly dependable piping installation.

The illustration shows how a welding operation on 14" high pressure, high temperature piping is performed. The area adjacent to the weld is induction preheated to a temperature of 500°F. min. This temperature is accurately maintained during the entire electric arc-welding operation by means of indicating and control instruments. When the weld is finished, stress-relieving is accomplished by similar procedure.

Better welding contributes to the safer, more satisfactory prefabricated piping installations produced by Pittsburgh Piping and Equipment Company.

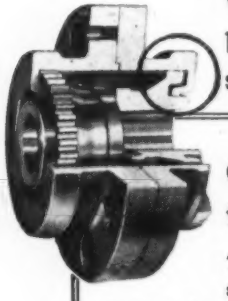
Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
315 West 9th Street, Los Angeles
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
Whitehead Building, Atlanta

Current Stock of Fast's Couplings at our Baltimore, Md. plant insures immediate delivery. (Photo Jan. 31, 1947)

In Emergency, *Immediate* Delivery on FAST'S Couplings

Our usual prompt service on couplings can be stepped up in an emergency. Shutdowns cost money and it is important to remember that Fast's Couplings can be supplied fast—*usually immediately* in an emergency.



We can back up this promise because we maintain a large stock of Fast's Couplings at Baltimore, Maryland, service stocks at Chicago, Illinois . . . Minneapolis, Minnesota . . . Detroit, Michigan . . . and complete stocks at Portland, Oregon . . . San Francisco, California . . . Los Angeles, California . . . Tulsa, Oklahoma . . . and Fort Worth, Texas.

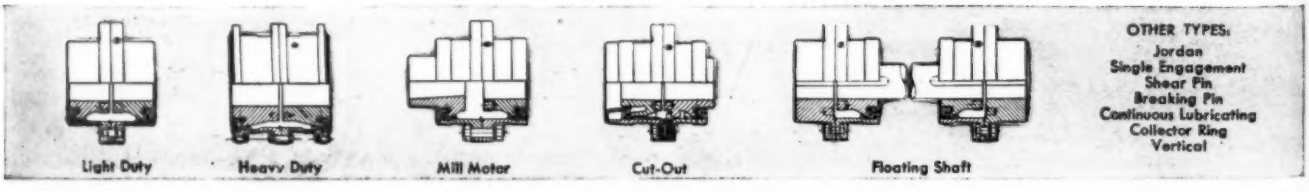
When you specify Fast's Couplings, you can count on them being delivered when you want them. Write . . . wire . . . or phone today to: Koppers Company, Inc., Fast's Coupling Dept., 243 Scott Street, Baltimore 3, Maryland.

Only FAST'S Gives You this Extra Protection

The *exclusive* "rocking bearing," shown in the circle, is one more reason for ordering Fast's Couplings, *now*. It provides a positive metal-to-metal seal to guard the load-carrying oil against moisture, dust and grit. Note that *no* perishable packing rings are used.

KOPPERS

FAST'S *self-aligning* COUPLINGS



JUST THE SAME!

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

BEATS TOUGH CORROSION CONDITION

This 554-foot chimney was built* in 1936 for International Nickel of Canada to handle gases from copper reverberatories and converters. Now, after ten tough years, the smoke goes up this chimney just the same as the day the stack was built!

TEN YEARS WITHOUT REPAIR

The gases contain SO_2 with moisture content slightly above atmospheric humidity. Despite this corrosive condition, up to the present time no repairs have been made to this stack, and no evidence of deterioration has been noticed.

HERE'S WHY:

The entire lining of this stack was built with acid-proof brick laid in Penchlor Acid-Proof Cement.** In addition the top fifty feet of this stack was further protected by using Penchlor Acid-Proof Cement for pointing the outside surface joints. Penchlor Acid-Proof Cement is a superior sodium silicate cement that is quick-setting and self-hardening. Its outstanding record of satisfactory service has been proved in chemical plants, steel mills, paper and pulp mills, oil refineries and smelting plants.

SEND FOR CASE REPORT

If you have a corrosion problem, you'll be interested in further details about this Penchlor installation, as well as an illustrated brochure on Penchlor. Write for Case Report Number 69-3.

Special Chemicals Division

PENNSYLVANIA SALT MANUFACTURING COMPANY

1000 Widener Building, Philadelphia 7, Pa.

NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI • WYANDOTTE • TACOMA • PORTLAND, ORE.

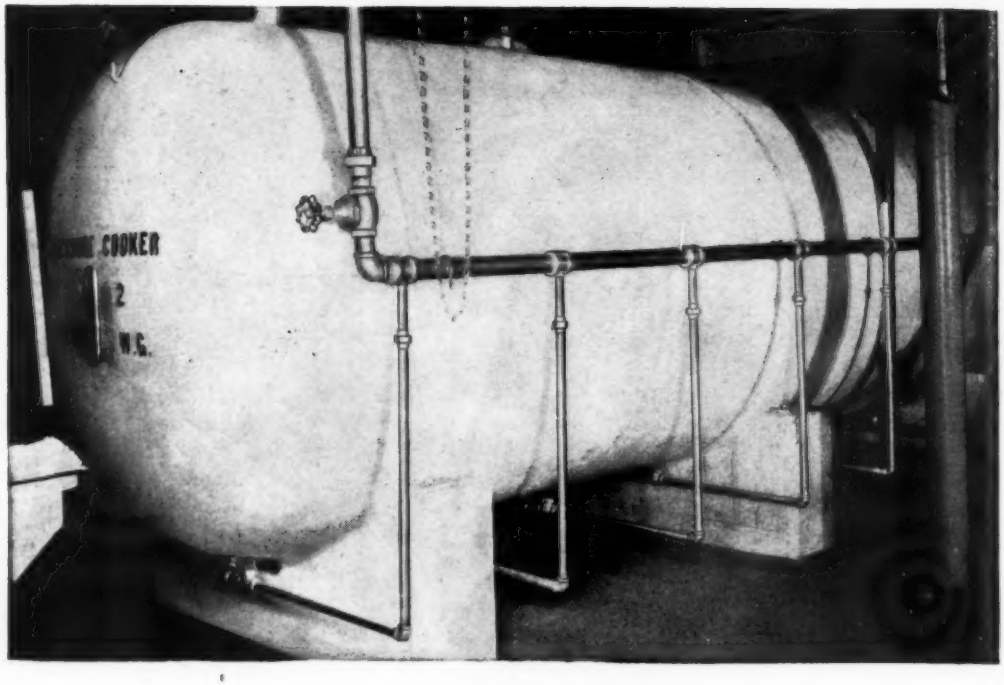
PENN SALT

CHEMICALS

97 Years' Service to Industry

*Built by Custodis Canadian Chimney Company, Limited, Montreal

**Penchlor Acid-Proof Cement was furnished by our Canadian Associates G. F. Sterne & Sons, Ltd., Brantford, Ontario



The high Rust Inhibition of Eagle Super "66" Insulating Cement pays you an extra dividend!

Yes, Eagle Super "66" Insulating Cement gives you an important "extra" — a rust inhibitive quality that helps prolong the life of your heated metal equipment, thus saving costly repairs and replacements. Extensive tests have proved that in addition to doing a tremendously efficient job of insulating, Super "66" actually inhibits rust!

"Springy Ball" structure. Super "66" is made up principally of "Springy Ball" Mineral Wool pellets, literally honeycombed with dead air cells. These dead air cells effectively block the escape of heat — give Super "66" extremely low thermal conductivity.

"Springy Ball" Structure

Super "66" withstands a full range of temperatures up to 1800° F., and if not used at temperatures above 1200° F., *can be removed, remixed and reused!*

All-purpose — easy to apply. Super "66" can be applied easily and quickly to most any size or shape surface. Just mix with water, spot over surface and trowel to desired thickness.

High coverage. As high as 65 sq. ft. per 100 lbs. wet. Shrinkage, which occurs in thickness only, is less than 15%.

Send for data sheets. They contain complete technical information about Eagle Super "66." Available on request.

FREE Manual! Gives examples of how industrial insulation effects large fuel savings. Includes Heat Loss Estimate Sheet for your use. Write for your copy.

Other Eagle Industrial Products include:

EAGLE INSULSEAL. A protective coating for insulation. Trowels on — dries to a hard finish. Withstands up to 450° F.

EAGLE SWETCHEK (black). A prepared, asphaltic base, rust-inhibitive anti-condensation compound.

EAGLE DRYCOTE (white). A dry, ready-to-mix, rust-inhibitive anti-condensation compound.

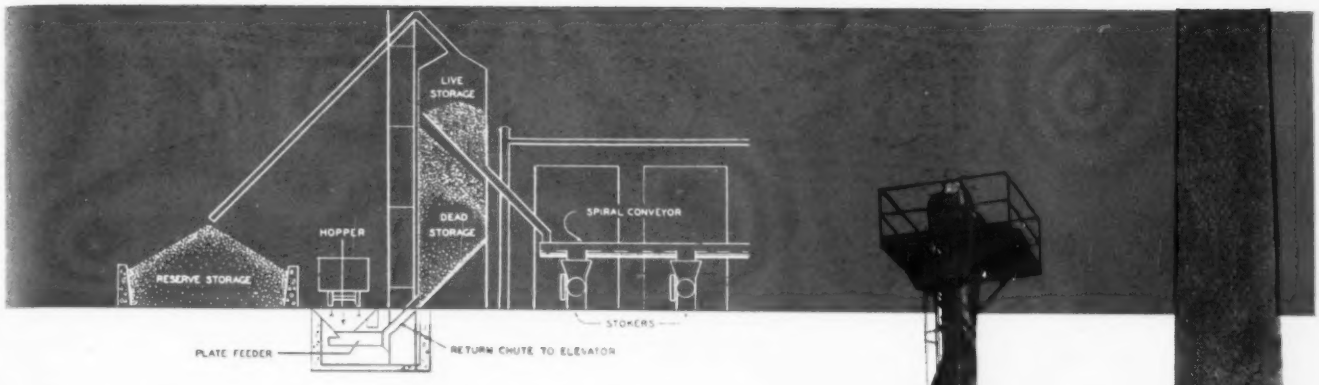
EAGLE "43" FINISHING CEMENT. A hard white finish coating for all types of indoor insulation within a range from 70° F. to 800° F.

EAGLE-PICHER INSULATIONS
High and Low Temperature

EAGLE EP PICHER

Made by THE EAGLE-PICHER COMPANY • CINCINNATI (1), OHIO

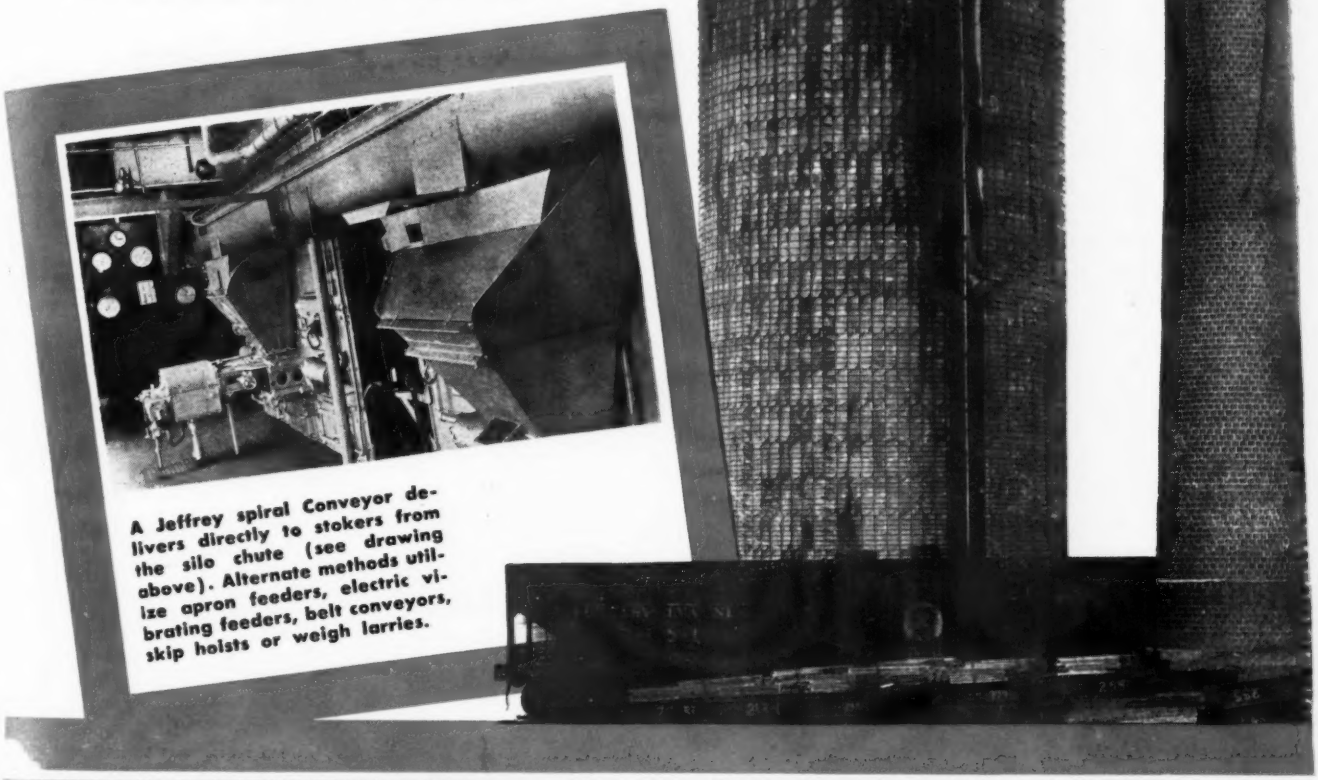
Eagle Super "66" Insulating Cement • Eagle L-T and M-2 Felt • Eagle Supertemp Block • Eagle Blankets • Eagle Pipe Covering
Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetchek • Eagle Drycote



ENCLOSED STORAGE WITH SPIRAL FEED

Here's another typical Jeffrey installation with the advantages of handling large capacities in minimum space. For this and other coal and ash handling economies our Power Plant equipment Catalog No. 778 will come in handy. Send for your copy TODAY.

A Jeffrey spiral Conveyor delivers directly to stokers from the silo chute (see drawing above). Alternate methods utilize apron feeders, electric vibrating feeders, belt conveyors, skip hoists or weigh larries.



THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

932-99 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 1 · Buffalo 2 · Cleveland 11 · Harlan · Jacksonville · Pittsburgh 22
Birmingham 3 · Chicago 1 · Denver 2 · Houston 5 · Milwaukee · St. Louis 3
Boston 16 · Cincinnati 2 · Detroit 13 · Huntington 17 · New York 7 · Salt Lake City 1
Philadelphia 3 · Scranton 3

FLEXIBLE COUPLINGS

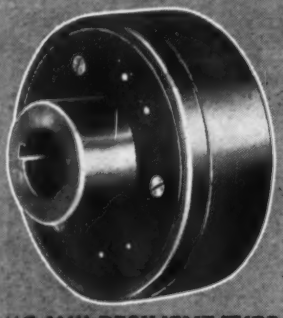
PHILLIE GEAR

—any SIZE or TYPE
...for any service

We make or distribute various types of couplings in both the rigid and flexible styles, and our recommendations are based upon the actual experience our Engineering Department has had with various couplings in service. . . . Thus, our customers can be assured of an unbiased recommendation.

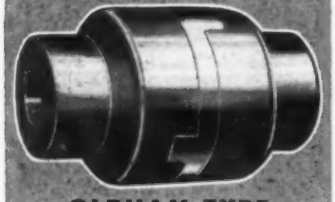
Popularly used sizes of most couplings are carried in stock and deliveries can be made quite promptly.

Shown here are the different types of *Flexible Couplings* which we can highly recommend to best meet the required needs.



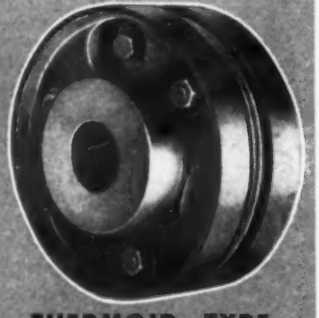
"C-W" RESILIENT TYPE

The most resilient coupling and best suited for extreme torsional vibration applications, but not recommended where there is frequent reversal of torque.



OLDHAM TYPE

Is recommended for speeds of 50 R.P.M. and below, and particularly adapted for installations where parallel misalignment errors are relatively large, and where angular misalignment errors are inappreciable.

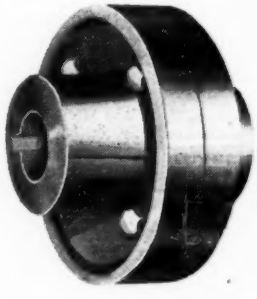


THERMOID TYPE

Designed and built to meet the demand of a more flexible and vibrationless coupling.

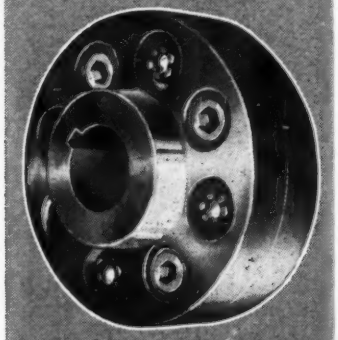
SEND FOR CATALOG 150

and please use your Business Letterhead.



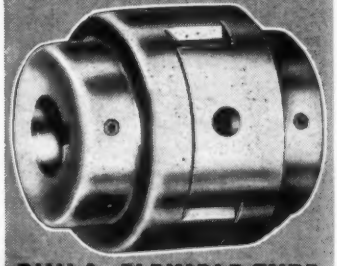
STEEL FLANGED TYPE

A rigid coupling, and should not be used where both shafts are rigidly supported in bearings. Recommended for vertical drives such as agitators, where there is no lower bearing, or only one guide bearing.



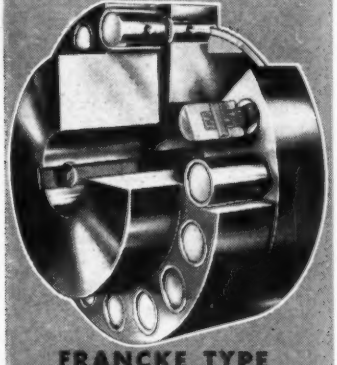
AJAX TYPE

Specially constructed to absorb and dampen shock, vibration, starting torque and momentary overload — by means of live rubber bushings.



PHILA. FLEXIBLE TYPE

Widely used for "general purpose" work. . . . Flexibility is obtained (without the use of flexible materials) by means of a floating center block of non-metallic material.



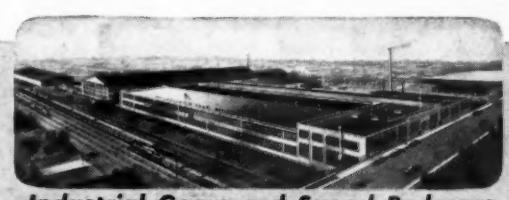
FRANCKE TYPE

Well suited where torsional resilience is required with all-metal construction.

Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls

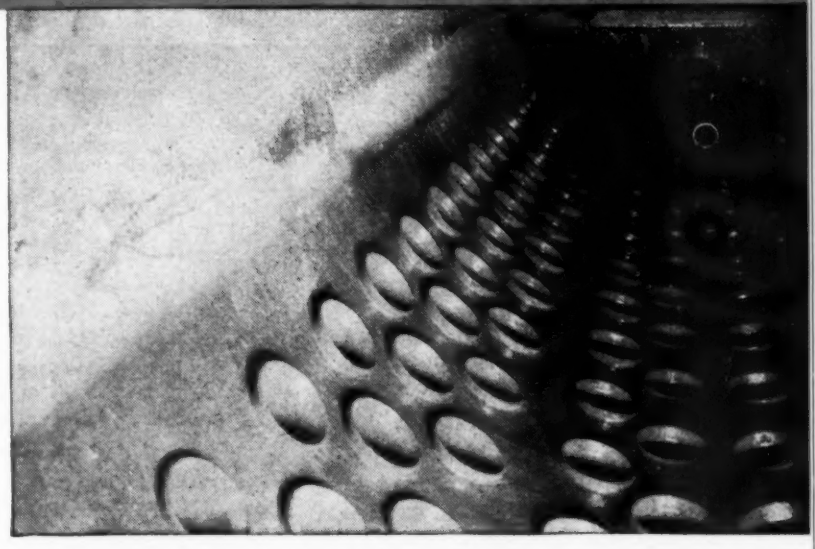
DOWELL

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

this boiler was

thoroughly cleaned

the chemical way



Leading engineers, responsible for power plant efficiency, have found in Dowell's *Chemical* cleaning service a modern method for *reducing costs*. They know that more efficient operation of boilers, condensers, and other heat-exchange equipment is achieved easily after chemical scale removal service. Power plant operators can see for themselves how safe, how rapid, now effective this tested process really is—when applied by *specialists* in chemical cleaning.

Dowell engineers fill the equipment with liquid solvents designed to dissolve and disintegrate the accumulated scale and sludge. They are experienced in practical methods, know which solvents to use, and bring with them adequate equipment—special truck-mounted tanks, pumps, mixers, heaters—for complete control of each stage in the successful job.

To save dismantling and down time—to reduce operating costs—call Dowell. Ask for free color booklet "More Power to America's Industry!"

FREE SHOWING! *New 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. To arrange a special showing call or write Dowell.*

DOWELL INCORPORATED • TULSA 3, OKLAHOMA

New York, Philadelphia, Boston, Baltimore, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Kansas City, Wichita, Oklahoma City, Houston, Fort Worth, Shreveport, Mt. Pleasant, Michigan; Salem, Ill.; Borger, Texas; Wichita Falls, Texas; Midland, Texas; Lafayette, La.
Long Beach, Casper: Dowell Associate—International Cementers, Inc.

owell's industrial engineers are oroughly experienced in successful emical cleaning. They are supported y the full research and technical re-urces of Dowell's own laboratories.

Dowell's field equipment includes the most modern types of scientific devices. Solvents for Dowell chemical scale removal service are mixed especially to fit each individual job.

DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

X-RAY VIEW

Shows why you can't match the New 1947 Modine Unit Heater Line!

All copper and copper alloy condenser, brazed construction, fins metallically bonded to tubes.
Seamless red brass tubes preformed to provide individual expansion bends, absorb stresses.
Motor protected from condenser radiant heat.
MOD
Standard Cone-Jet deflector permits wide choice of heat distribution patterns.
Inhalating gap provides greater air volume and velocity, lower outlet temperature.

Cross Section, Vertical Delivery Type Unit Heater

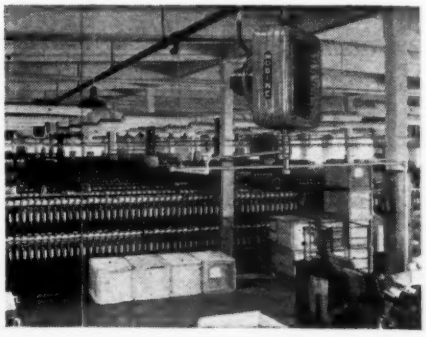
NEW STYLE AND BEAUTY . . . improved heating performance . . . a broad new range of applications for stores and plants — that's what the new 1947 Modine Unit Heater Line now gives you! Never before has propeller unit heater design been so closely adapted to the space-heating needs of modern industrial and commercial buildings — to the expanding applications of unit heating — or to the critical requirements of unit heater application engineers!

And that's not all! Compare the outstanding features of the new 1947 Modine Unit Heater Line. Modine now gives you three separate and distinct types of unit heaters — a matching, integrated line with 47 basic capacities: 1) Horizontal Delivery Type for general industrial and commercial applications — 2) Vertical Delivery Type for overhead installations — 3) New Power Throw Type for specialized industrial use.

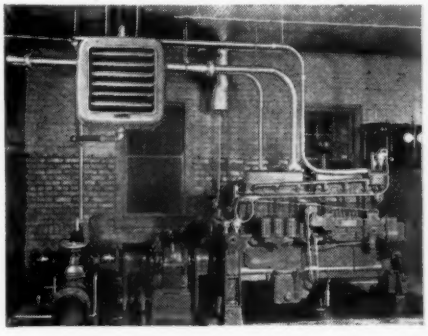
If you're planning to build a new plant or store, investigate the Modine line. For complete information, see the "Where-to-Buy-it" Section of your phone book, or write for free descriptive literature.

Modine UNIT HEATERS

Here's Latest News about Modern Unit Heating!



CONTROL HEAT DISTRIBUTION as easily as you control light! No other heating method lends itself so easily and economically to zone control as does unit heating. When production is temporarily limited to certain working areas, only unit heaters serving those immediate areas need be operated. On days when heat loss in one part of a plant is greater than in another (due to wind and exposure), unit heaters serving the colder area can be run more frequently or for longer periods of time.



STOP HEAT WASTE! Unit heaters can be profitably used to recover and distribute waste heat generated by Diesel engines. Jacket water from Diesels is circulated through unit heaters, which transfer waste heat from the water to air and distribute it into areas requiring heat. Result: A two-way benefit — 1) unit heater cools jacket water, 2) heats room.

Important:

Right now, in the face of material shortages, we are doing our utmost to meet the tremendous demand for Modine Unit Heaters. If there is delay in filling your order, please be patient. When your new Modines are installed, we think you'll agree they were well worth waiting for.

MODINE MFG. CO.
1830 Racine Street, Racine, Wisconsin

SHORT, SHORT Profit STORY

TYPICAL W & T DE-SLIMING INSTALLATION

$11,000 a year from cooling water

A progressive midwestern power company has been using the W & T intermittent De-Sliming Process on condenser cooling water for over ten years. Here's what they report for a typical year:

Fuel saving	$9900.00
Labor saving	4000.00
Gross saving	$13900.00
Operating and depreciation cost	$2900.00
NET SAVING	$11000.00

In addition, they have eliminated the disagreeable job of plug cleaning, have all units always available at maximum capacity and make more efficient use of existing cooling water supplies without additional expense.

W & T Field Engineers will be glad to discuss the application of chlorination through the Intermittent De-Sliming Process to your condensers and heat exchange equipment. Call on them freely or write for technical information today.

CD-25

WALLACE & TIERNAN
PRODUCTS, INC.
BELLEVILLE 9 NEW JERSEY

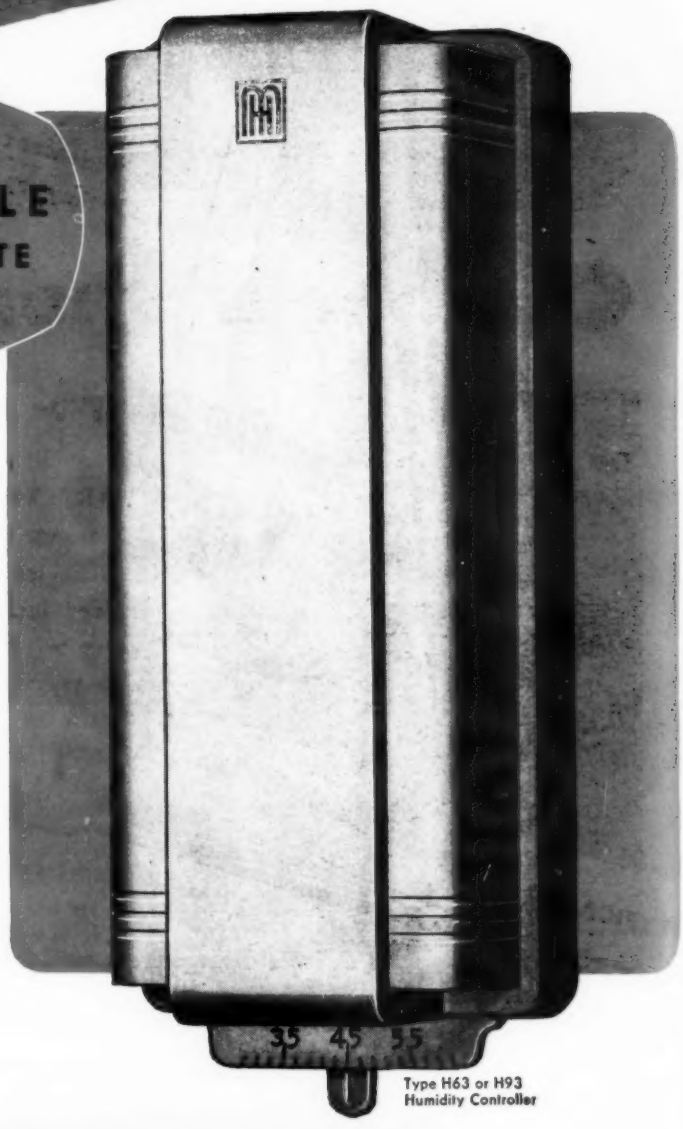
Announcing

A NEW

HONEYWELL

ELECTRIC HUMIDITY CONTROLLER

NOW AVAILABLE for IMMEDIATE DELIVERY

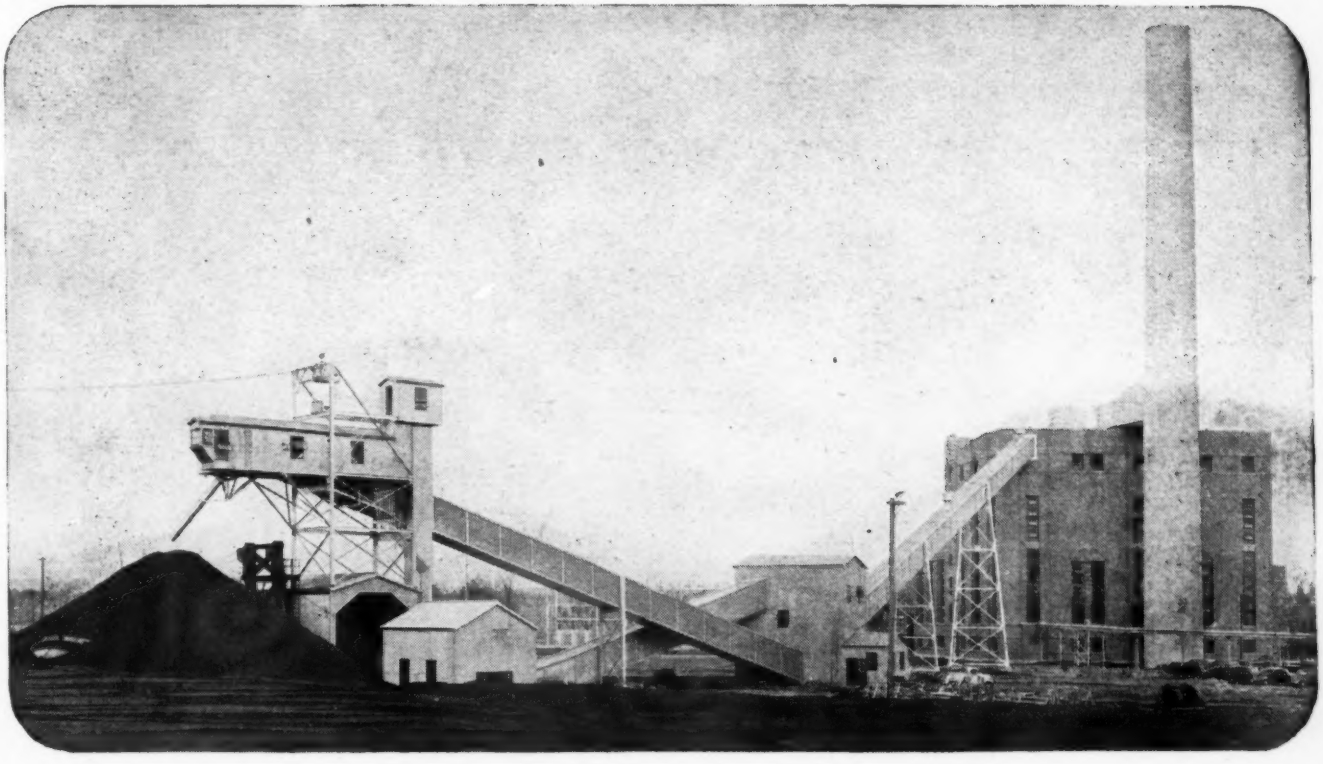


Type H63 or H93 Humidity Controller

TO COMPLETE its line of humidity controllers, Honeywell offers the new H93 electric modulating Humid-U-Stat as a companion to the dependable and rugged H63 on-off electric Humid-U-Stat and the H0900 pneumatic humidity controller.

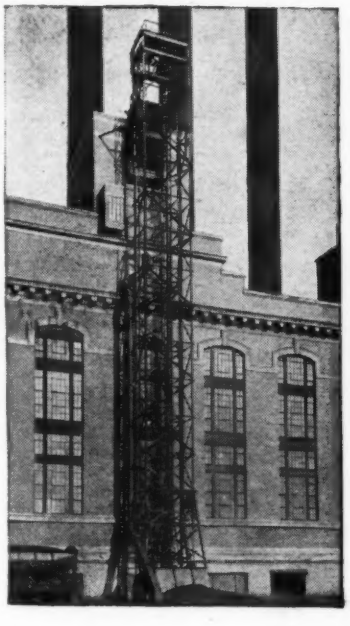
Install a Honeywell product wherever humidity control is required. There is a Humid-U-Stat for every need from general purpose applications to the most exacting requirements. And always, with every Humid-U-Stat, you are backed by the Honeywell name. That means you benefit by proved performance, the Honeywell reputation for dependable, trouble-free service and the broad background of Honeywell experience and technical assistance is available whenever needed. Get complete data about the Humid-U-Stat line by writing Minneapolis-Honeywell Regulator Co., 2607 Fourth Ave. So., Minneapolis 8, Minn. Branches and distributing offices in principal cities.

MINNEAPOLIS Honeywell CONTROL SYSTEMS



CENTRAL STATION COAL HANDLING

from receiving hopper to boiler



BARTLETT-SNOW central station coal handling is adapted to receiving coal by rail, over water-ways or by truck—and includes storage and reclaiming. Complete facilities are provided including belt, apron, reciprocating and duplex feeders; belt conveyors and belt trippers; crushers and breakers; skip hoists which are highly favored when space is limited—bins, bunkers and distributing conveyors, dust hooded and vented if desired. The equipment can be partially exposed to outside view, or entirely enclosed permitting the building to conform to any desired architectural style. Our long and specialized experience—proven design—and fixed unit responsibility are positive assurance of efficient, satisfactory operation. Send for Bulletin No. 83. It contains much information of interest to engineers and operating men.

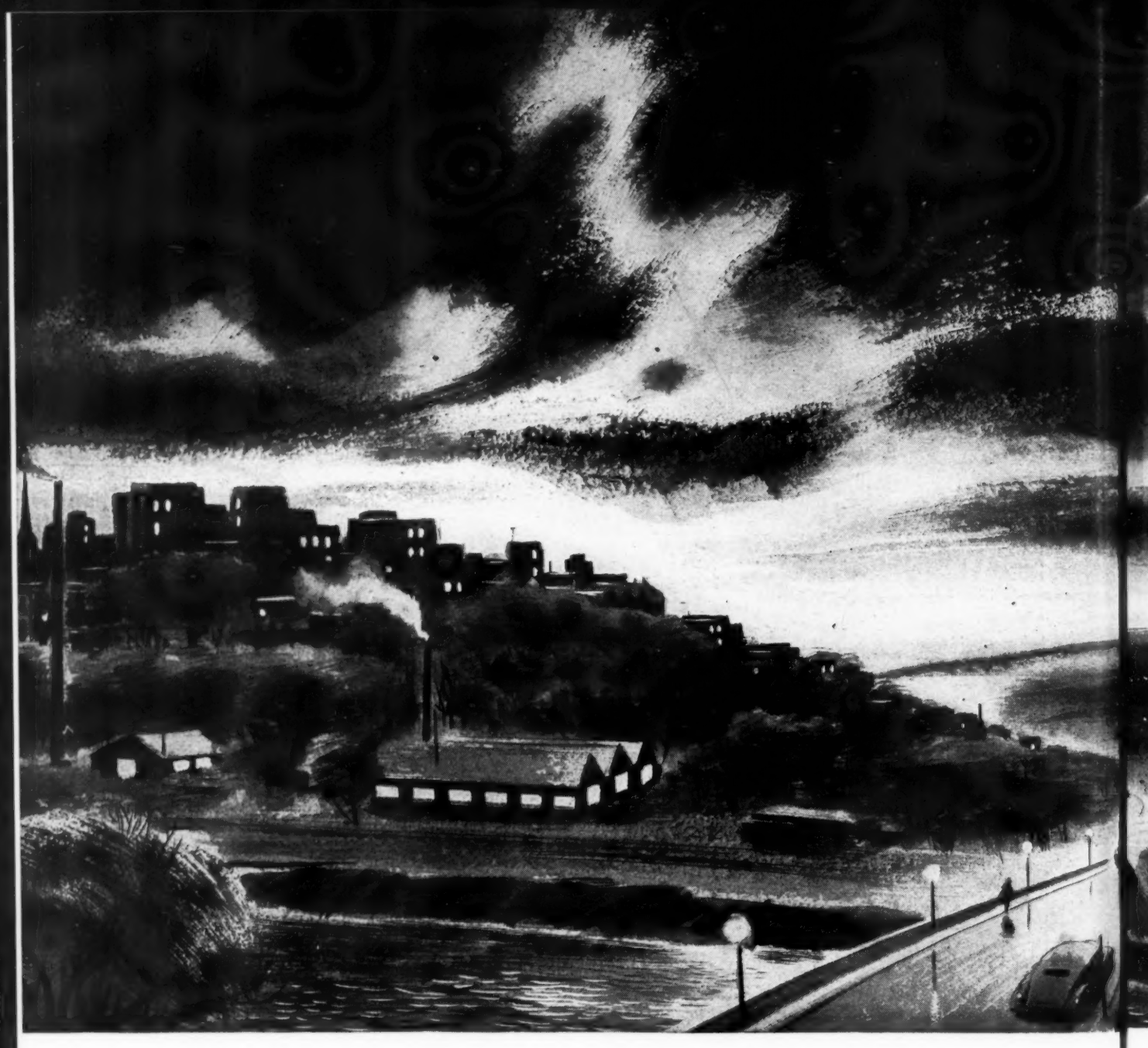
THE C. O. BARTLETT & SNOW CO.

6205 Harvard Avenue, Cleveland 5, Ohio

Engineering and Sales Representatives in the Principal Cities

●

COAL HANDLING FOR CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS



Light Bringer

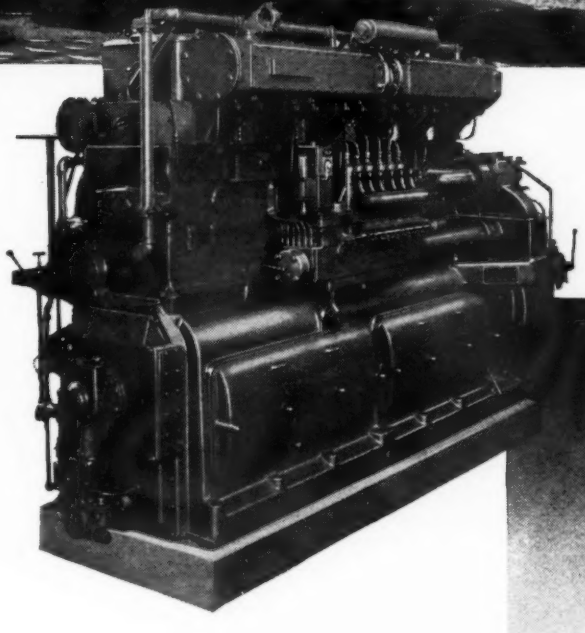
IT IS late afternoon. In the power station, by the river, a generator hums, driven by an ALCO diesel engine. Similar units stand by, waiting.

Overhead a cloud appears, widens, darkens, blots out the sun. Through the sudden gloom lights appear in factories, offices, stores, homes. The power station load shoots upward.

Smoothly, the rising load is picked up as the idle ALCO diesel engines are started. There is no overload, no drop in pressure, no failure of service. Ample power is *immediately* available.

Rugged, compact, high-speed ALCO diesel engines are built for heavy duty; they provide maximum power per pound of engine weight, and per square foot of space occupied.

These are important advantages for practically any power unit application for either stationary or marine service.

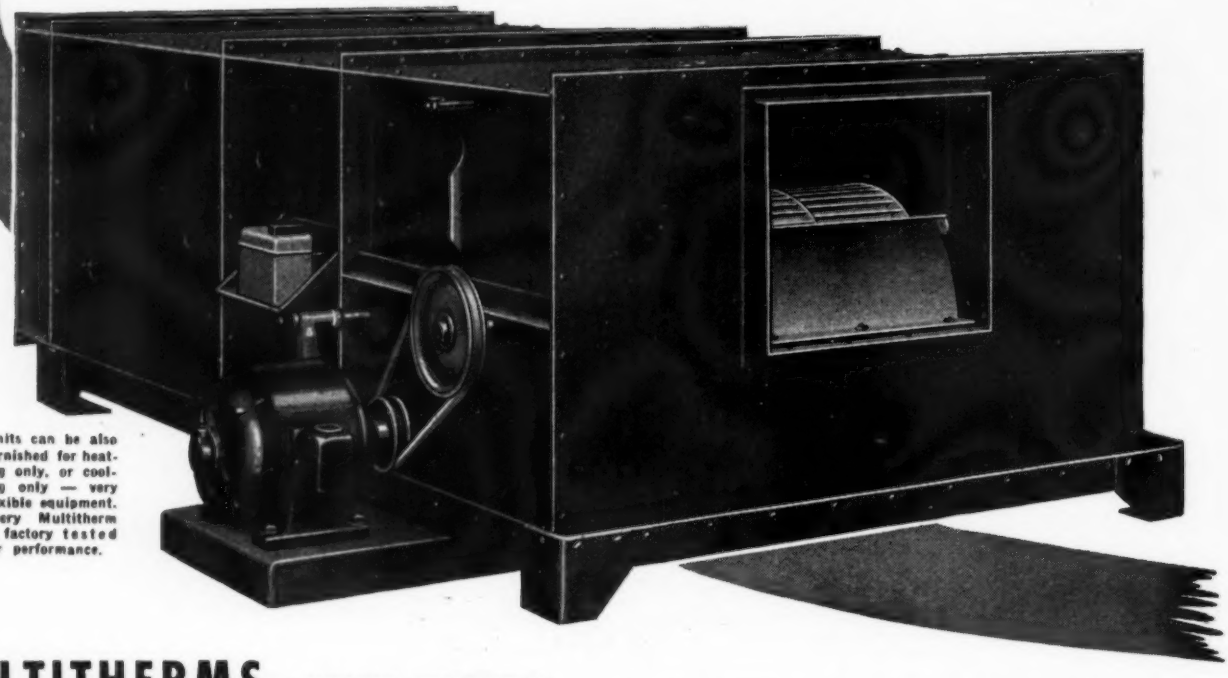


American Locomotive

Alco

THE MARK OF MODERN ENGINEERING

HERE'S ONE OF THE MOST EFFICIENT WAYS
AIR CONDITION



*Units can be also furnished for heating only, or cooling only — very flexible equipment. Every Multitherm is factory tested for performance.

MULTITHERMS—WHOLE "WORKS" IN ONE ASSEMBLY . . . BUILT FOR ALL SORTS OF INDUSTRIAL AND COMMERCIAL APPLICATIONS

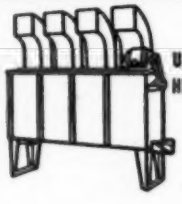
The Clarage Multitherm unit shown above is a complete conditioning plant* . . . (1) it *cleans* the air, removing bacteria, pollen and dust . . . (2) it *cools and dehumidifies* in summer utilizing cold well water, brine or a direct expansion refrigerant . . . (3) it *heats and humidifies* in winter using steam or hot water . . . (4) it supplies at all times a circulation of conditioned air under positive fan pressure.

Multitherms are as easy and inexpensive to install as unit heaters — and just as satisfactory in operation. They may be suspended from the ceiling, mounted on platforms, or installed on the floor. Sizes range from 400 to 13,600 c.f.m. If the job is extra large, it can be handled with two or more units.

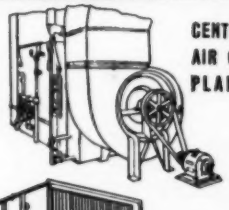
Look into Clarage Multitherms if you have any type of air conditioning problem. They are engineered to give precision results — compact to save space — of heavy duty construction for years of continuous trouble-free service. *And, as compared to central station conditioning, you can usually save considerable money.*

Write us, outlining your requirements — or ask for Bulletin 107 giving complete information.

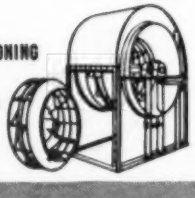
SOME OF OUR OTHER PRODUCTS



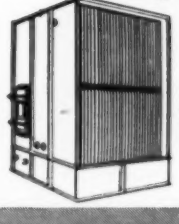
UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS

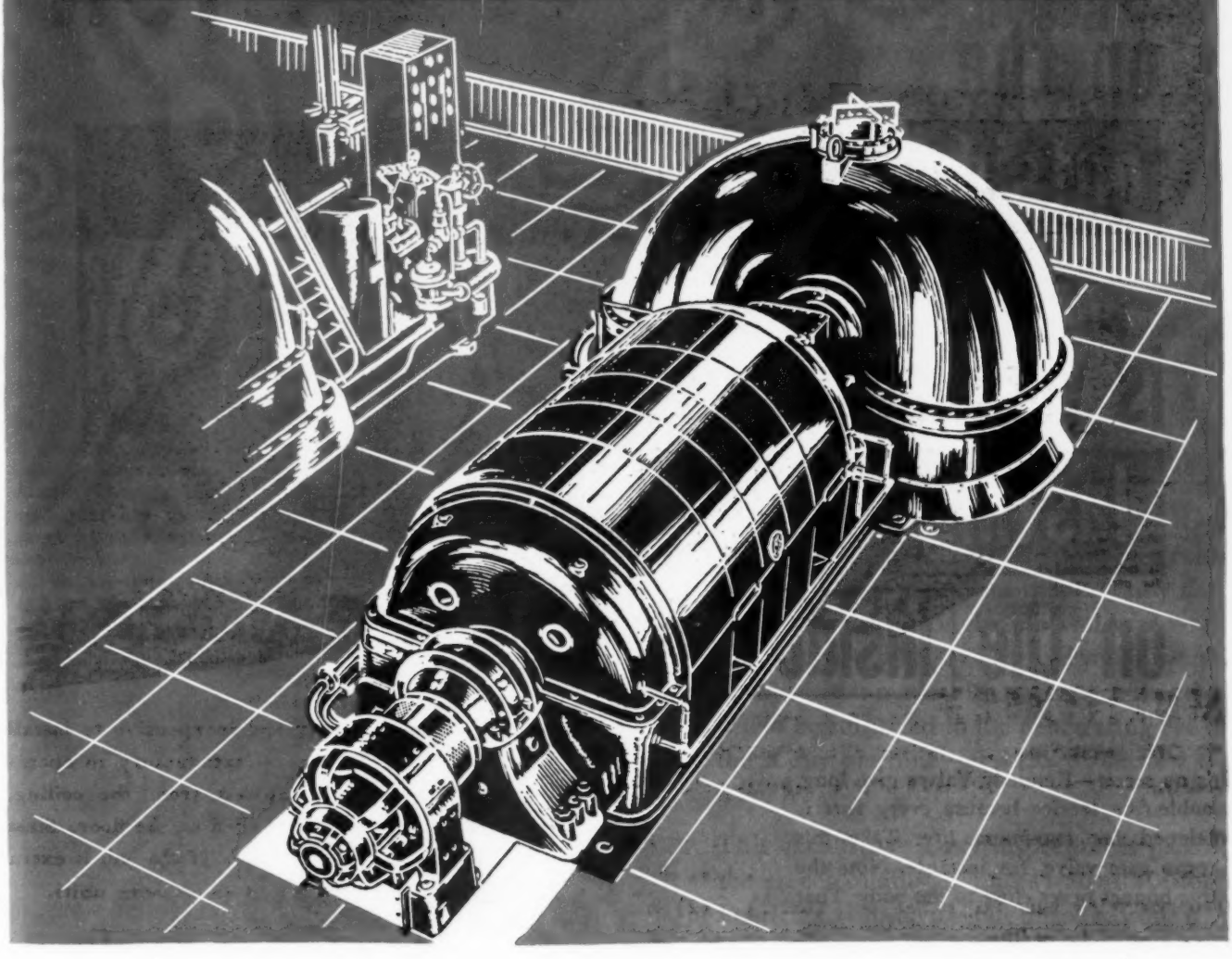


AIR WASHERS

CLARAGE
FAN COMPANY
Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

"ABSOLUTE ABSENCE OF SLUDGE



...since using Tycol turbine oils"

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Pittsburgh • Philadelphia

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE • NEW YORK 4, N. Y.

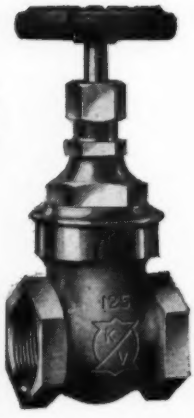
"Ten years without an oil change...
Bearings show no sign of wear..."

These results are typical of the unusual performance achieved with Tycol Turbine Oils. Refined by a special process, these modern lubricants stand up under the toughest service conditions . . . retain their original characteristics.

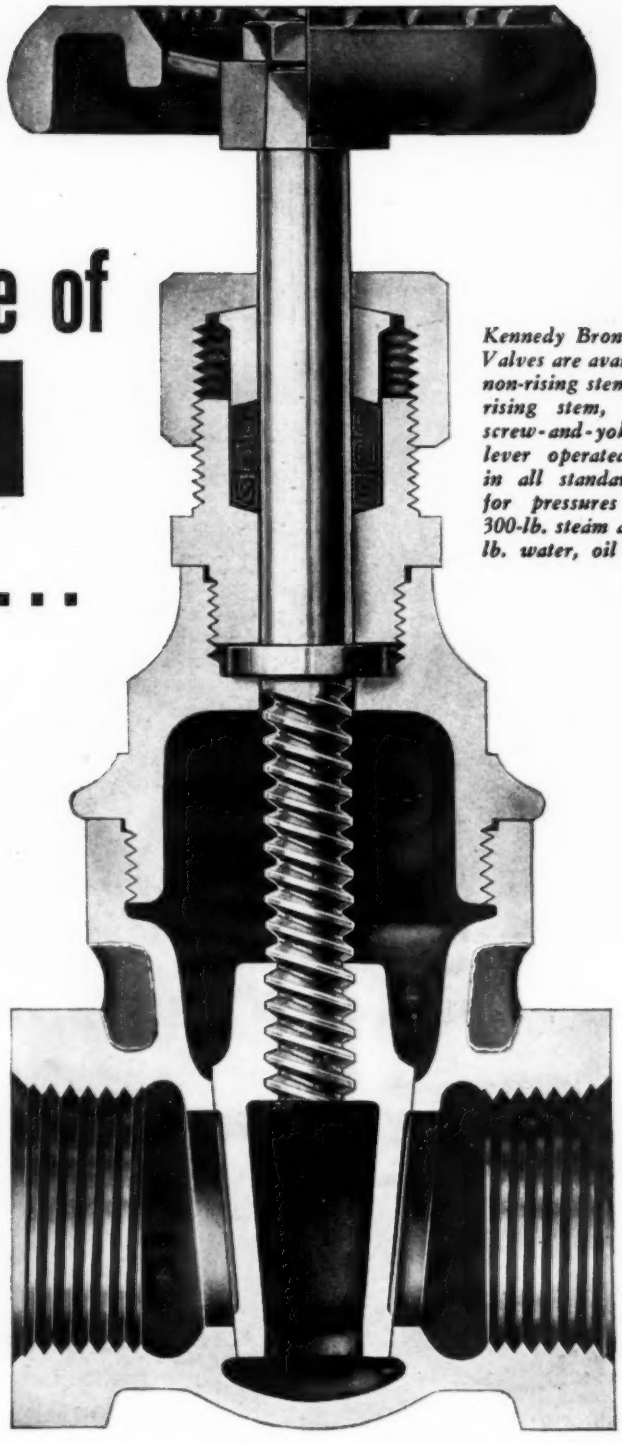
Call your nearest Tide Water Associated Office today for full information about the time- and money-saving advantages of Tycol Turbine Oils. Rust inhibited *Tycol RIO Turbine Oils* are also available for operations where corrosion is a factor.

LUBRICATION—"ENGINEERED TO FIT THE JOB"

This... on the outside



is your assurance of lasting service on the inside .....



Kennedy Bronze Gate Valves are available in non-rising stem, inside rising stem, outside-screw-and-yoke, and lever operated types, in all standard sizes for pressures up to 300-lb. steam and 600-lb. water, oil or gas.

It's no secret—Kennedy Valves give long, trouble-free service because every part is designed for maximum life. Take this bronze gate valve, for instance. Note the large bonnet hexes close to the body. That prevents body distortion. See the large number of heavily proportioned stem threads . . . the simple, strong, accurately guided disc.

Look at *any* valve that has Kennedy on the outside. You'll find an abundance of long life features . . . all of them fully described in Kennedy's 240-page Catalog, along with complete information on Kennedy bronze and iron-body gate, globe, angle and check valves, pipe fittings and flanges, and other valves and accessories. Write for your copy today.

BUY FROM YOUR LOCAL DISTRIBUTOR

KV-148

KENNEDY valves-pipe fittings-fire hydrants

THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK *Offices and Warehouses in Principal Cities*

1,000 X-Rays a day to avoid one possible flaw...

An expert welder may make 1,000 perfect passes before one minute flaw shows up. Kellogg doesn't risk even that one chance in a thousand!

To begin with, every welder in the Kellogg shops must qualify for X-ray inspected work. In addition to constant routine supervision on the floor, as many as 1,000 X-rays of welds are made daily to prevent that one tiny flaw from slipping through. No welder knows which jobs will be X-rayed and which won't. Every weld is made with the expectation that it *will* be subjected to the penetrating eye of the X-ray machine—*and that's the way we want it!*

This exhaustive X-ray inspection is part of the unseen quality that goes into all Kellogg Fabricated Products—one of the reasons why so many jobs—where perfection is all important—are entrusted to Kellogg.

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
TULSA • HOUSTON • TORONTO • LONDON • PARIS

VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

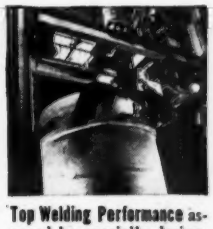
Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

Complete Facilities for fabricating of steel products from simple forgings to the most intricate 120 foot towers.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.

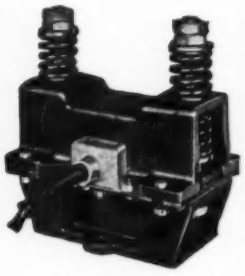


Top Welding Performance assured by specially designed equipment... exclusive employment of master operators.

SYNTRON

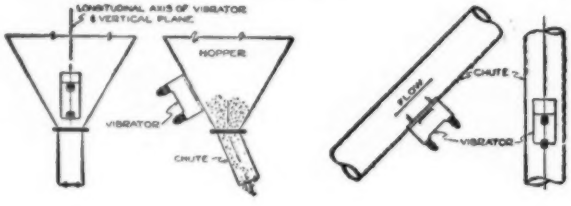
"Pulsating Magnet"

ELECTRIC VIBRATORS



Keep Coal Moving

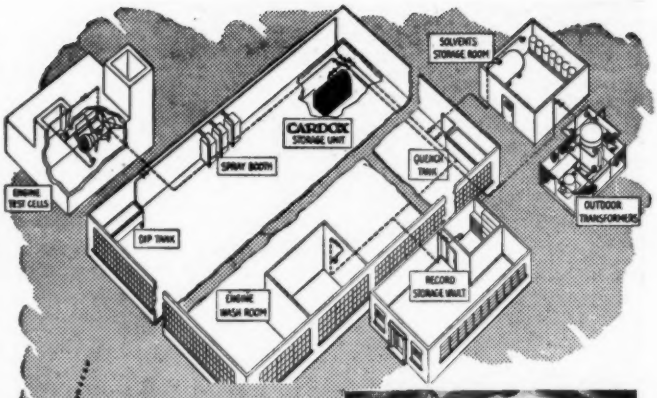
—out of bins, hoppers and chutes



Powerful, pulsating electromagnets, with rheostat control of power, that break down arching and plugging.

Send us a description of your particular problem —giving thickness of hopper wall, cubic content, etc.—we'll be glad to submit recommendation.

SYNTRON CO., 492 Lexington, Homer City, Pa.



CARDOX

GIVES DOUBLE PROTECTION FOR TOUGH FIRE HAZARDS

DOUBLE—because the Cardox method of engineered application and control makes it entirely practical to provide enough fire-killing carbon dioxide to give "*double-shot*" safety to the largest hazard protected, multiple shot protection to other hazards covered by the system. This *ample reserve* that means uninterrupted protection *after* fire has been extinguished is a recognized principle of sound Cardox fire engineering.

DOUBLE—because *mass* application of Cardox CO_2 in *pounds* or *tons* means less fire damage. Burning time is cut to a minimum. Non-damaging carbon dioxide cannot harm costly equipment or material in process. There is no after-fire clean-up to cause costly production delays.

Cardox Fire Extinguishing Systems use low-pressure carbon dioxide—stored at 0° F. and relatively low pressure in a single, compactly designed, centrally located Storage Unit that holds from ¼ to 125 tons. The Cardox method of application and control and Cardox engineered equipment have broadened both the performance and protection scope of carbon dioxide—providing *all* the proved advantages of CO_2 extinguishment for tough fire hazards, single or multiple, large or small, indoors or out.

Why not determine for yourself whether this broadened application of carbon dioxide by Cardox Systems or mobile equipment may not be the most effective answer to the fire problems that concern you? Write for Bulletin No. 937.

CARDOX CORPORATION

BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices: New York • Philadelphia • Pittsburgh • Cleveland
Detroit • Los Angeles • San Francisco • San Diego

CARDOX

CO_2 FIRE EXTINGUISHING SYSTEMS

Offering YOU

Quality Simplicity Service

CASH-ACME Type "B" Pressure Reducing and Regulating Valves are constructed of Highest Quality materials . . . from tested and proven Engineering Specifications . . . by Skilled workmen.

Being a Direct Acting Valve its operation, and thus its maintenance, is simple . . . free of time consuming complicated mechanisms.

For use on STEAM, WATER, AIR, OIL, LIQUIDS and GAS LINES. Pipe sizes ¼" to 2" inclusive.

★ Write today for YOUR copy of our 28 page Catalog describing how CASH-ACME products can best serve you.

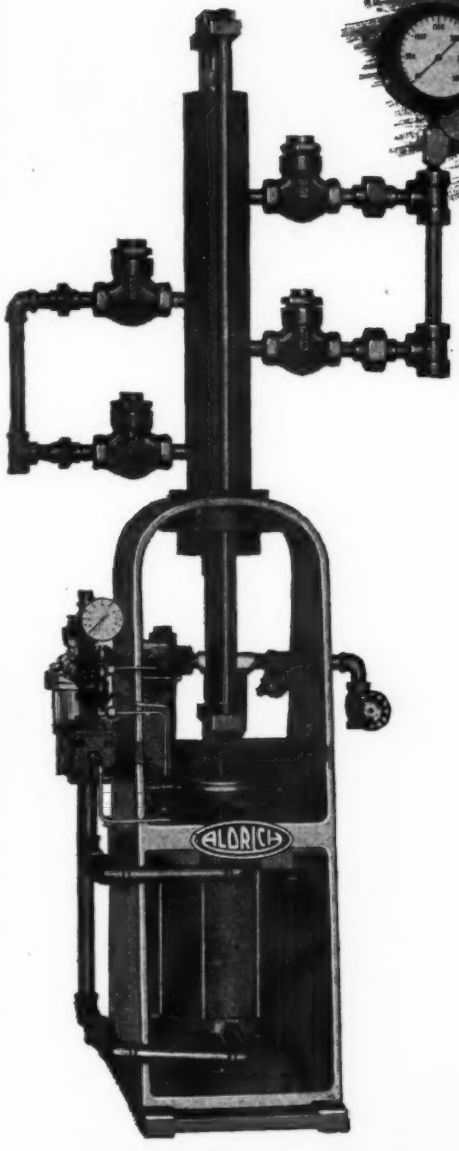
In Automatic VALVES its THIS name that counts

CASH-ACME

A.W. CASH VALVE MFG. CORP.
6662 EAST WABASH AVE.
DECATUR ILLINOIS

Here's a New Hydraulic Pump

For Hydrostatic Test Service
For Use with Hydraulic Presses
For Many Other Applications



Powered by air from your plant air pressure or a small commercial compressor, this new ALDRICH-LYTLE Hydropneumatic Power Unit is ideal for providing low-volume and high pressure service for hydrostatic test service, for use with hydraulic presses in small molding press plants and for other applications.

Simple in construction, highly efficient and economical in operation — this unit *uses a maximum of 100 lbs. of air pressure to provide up to 20,000 lbs. hydraulic pressure.*

Varying pressures can be obtained by simple adjustment of self-contained air pressure reducing valve — can be maintained without need for control devices or by-pass valve. "Wire drawing" through relief valve and other complications are eliminated, since pump stalls when desired hydraulic pressure corresponds to air pressure used.

ALDRICH

THE ALDRICH PUMP COMPANY 3 GORDON STREET ALLENTOWN, PA.

Detailed information on this new unit is now available. Investigate the possibilities for its use in your plant by filling out and sending the coupon opposite.

THE ALDRICH PUMP COMPANY
3 GORDON STREET · ALLENTOWN, PA.

Gentlemen: Please send me additional information on
ALDRICH-LYTLE HYDROPNEUMATIC POWER UNITS.

Name_____ Title_____

Company_____

Address_____

SPEEDY *Pipe Cutting* MADE EASY

Efficiency-balanced RIDGID PIPE CUTTER cuts true, fast, with least effort

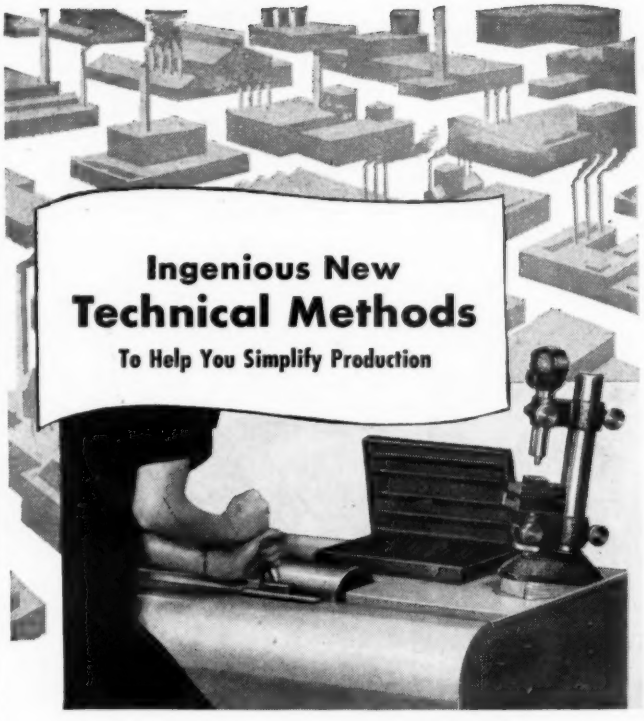
No. 42 4-wheel, fast quarter-turn cutting.

● It's less work to cut pipe with this new style RIDGID that rolls through any pipe fast and easily, leaves practically no burr. Beautifully balanced special malleable frame, its heavy-duty tool-steel wheel always cuts true, every cutter factory tested. Choice of 5 sizes to 6" capacity—4-wheel cutters to 4." Save time and muscle—buy at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY • ELYRIA, OHIO



Ingenious New Technical Methods

To Help You Simplify Production

New Centerless Lapping Machine Gives Precision of Less Than 2 Micro-Inches!

Now it's easy to lap cylindrical pieces—quickly—accurately—without specialized operator skill! The new Size Control Centerless Lapping Machine handles pieces from .010" to 10" diameter without costly set-ups.

Centerless Lapping Machine

The operator merely holds piece between lapping rolls with stick. Pressure applied determines quantity of metal removed. Small roll turns piece at slow constant rate. Large roll turns more rapidly to remove minute quantities of metal. Ideal for lapping oversize gages, worn gage plugs to next smaller size, bearings, bushings or shafts. Roll speeds easily changed. Adjustable for tapers.

Ideal also to save time on the job, is chewing gum. The act of chewing aids the workers' concentration; seems to make work go easier. Furthermore, chewing gum may be used even when both hands are busy—increasing worker safety—and reducing work interruptions. That is why many plant owners have made Wrigley's Spearmint Gum available to all.

You can get complete information from Size Control Company 2500 Washington Blvd., Chicago 12, Ill.

AB-55

Time-tested...

ACCURACY

BUILT INTO EVERY

HAYS-COCHRANE *friction-free* Electric FLOW METER

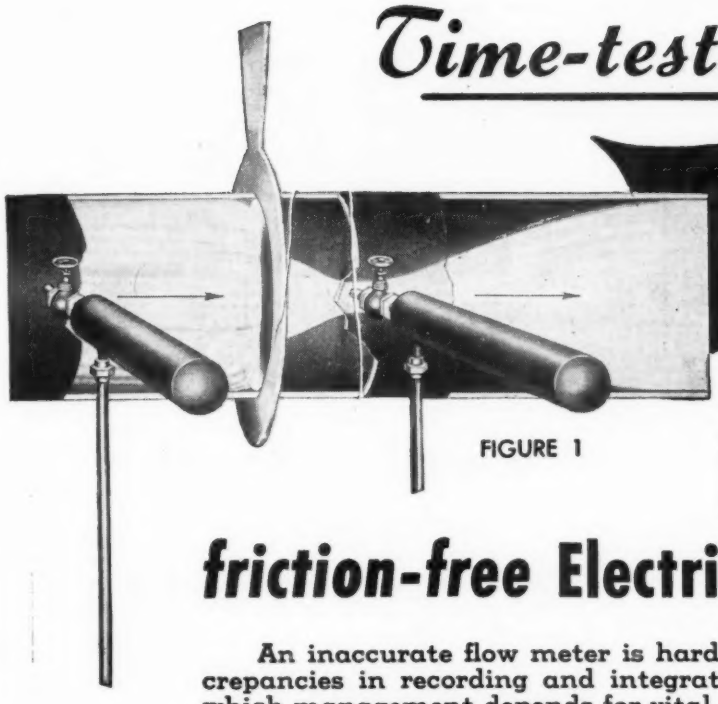


FIGURE 1

An inaccurate flow meter is hardly better than a good guess. Even slight discrepancies in recording and integrating flow can make valueless the records on which management depends for vital data.

In the Hays-Cochrane meter high accuracy is achieved by eliminating as much friction as is humanly possible and by applying sufficient power to compensate for the small amount of friction remaining.

The H-C transmitter (Figure 2) contains a mercury U-Tube, a non-metallic float on the mercury in the high pressure leg, two reactance coils, and a magnetic core supported by the float and positioned by differential pressure produced by orifice, nozzle or venturi in the pipe line (See Figure 1).

The Receiver (Figure 3), like the transmitter, contains two reactance coils and a core. A change in flow produces differential pressure change which moves float and core on the mercury surface of the Transmitter. Reactances of transmitter and receiver coils are thus unbalanced and a current flows through the galvanometer in the receiver, deflecting its boom. Indicator pointer, pen arm and integrator simultaneously show flow rate changes. This is accomplished with movement of the receiver core through a synchronous-motor-operated mechanical relay, which causes the galvanometer to regain null balance.

FIGURE 2
TRANSMITTER

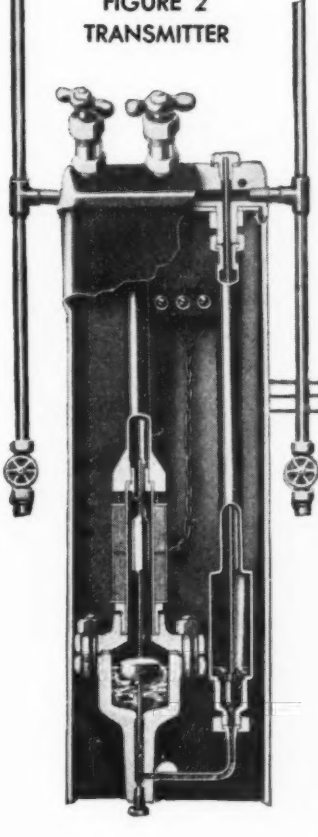


FIGURE 3 RECEIVER

There is no possibility of friction in the Hays-Cochrane Transmitter because there are no stuffing boxes, bearings, linkages or gears—merely a free-moving float positioning a core within a magnetic coil. The detecting circuit is not required to move any working parts other than the finely balanced galvanometer boom. These (indicating, recording and integrating mechanisms) are operated by a synchronous motor.

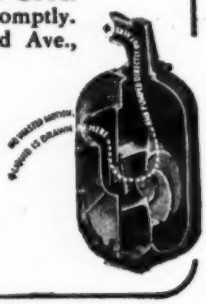
The HAYS CORPORATION
SINCE 1901 COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

COMBUSTION CONTROL • GAS ANALYZERS • CO_2 RECORDERS • DRAFT GAGES

4 advantages of Marlow self-priming Centrifugals:

1. SELF-PRIMING by exclusive "diffuser" method. Fast, certain and entirely automatic on suction lifts as high as 25 feet.
2. EFFICIENT. No auxiliary priming devices. Nothing to manipulate or adjust. No recirculation or wasted motion.
3. DEPENDABLE. Simple in design. No jets, ports or by-passes. No foot valves. No air binding.
4. ENDURING. Made for long, hard service. Will handle clear, gritty, heavy or volatile liquids.

1½ to 10-inch sizes. 25 to 3500 GPM. Interesting literature sent promptly. Marlow Pumps, 592 Greenwood Ave., Ridgewood, N. J.



Marlow Pumps

Manufacturers of Quality Pumps Since 1924

HOPPES
FEEDWATER HEATERS

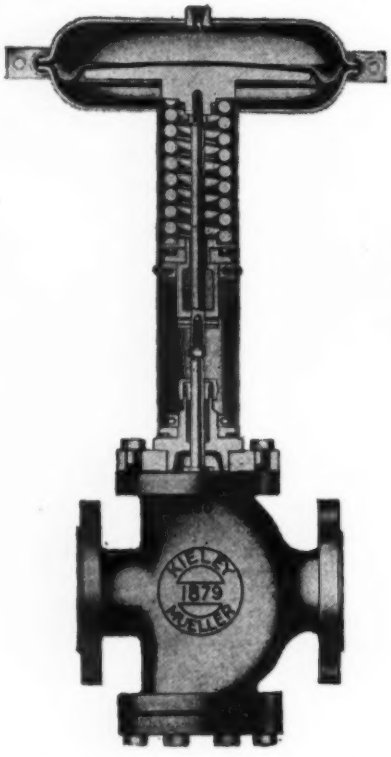
Deaerating and Non-Deaerating

Write for Bulletin

THE HOPPES MFG. CO.

Established 1881

SPRINGFIELD OHIO



OPEN
for inspection...

It's easy . . . any time . . . for inspection or maintenance. Just two clamp screws to open and the diaphragm casing is off. Just open the door in the yoke and the spring adjustment and stuffing box are exposed. For other equally important new features of the revolutionary new K & M KONTROL MOTOR, check this list:

- Pressed steel Diaphragm Casing . . . lighter . . . tougher.
- Rigid Welded Steel *Tubular* Yoke.
- Duo-seal molded diaphragm provides high travel, uniform loading.
- Long calibrated Steel spring . . . fully enclosed.
- Enclosed ball bearing spring adjusting screw.
- Streamlined Flow Valve Body for high capacity . . . unrestricted flow areas.
- Super finished Inner Valve Guides, *honed* guide bushings, top and bottom . . . for minimum friction; increased life.

KONTROL KIELEY & MUELLER MOTOR

Kieley & Mueller, Inc., 2033 43rd St., North Bergen, N. J.

Represented in

New York City	Houston	Pittsburgh	San Francisco	Dallas
Detroit	Los Angeles	Tulsa	Chicago	Denver
Cincinnati	Rochester	New Orleans	Baltimore	Portland

R/M HIGH PRESSURE PACKING

The quality of R/M High Pressure Packing, Style No. 122, is typical of the performance built into all R/M Packings.

No. 122 consists of a specially compounded resilient, heat-resisting rubber core, wound with bias-cut, long-fibre, asbestos cloth. It gives exceptional service on valve stems and steam or air reciprocating rods where surface speed does not exceed 600 feet per minute and temperature is not over 600°F.

A variation of this packing is Style No. 121, in which a core of asbestos cloth, backed with a resilient rubber cushion, is covered with asbestos cloth. No. 121 gives long and satisfactory service on steam hammers, steam pumps, steam engines, air compressors, valves, and other equipment where temperatures are not over 600°F.

Both packings are furnished either in coils, rings or spirals. They are but two of the many time-tested R/M Packings available for your special needs. For all packing problems call your authorized R/M distributor.

STYLE No. 122-S

R/M

RAYBESTOS R M MANHATTAN

RAYBESTOS-MANHATTAN, INC.

ASBESTOS TEXTILE & PACKING DIVISION

MANHEIM, PA. • BRIDGEPORT, CONN. • NORTH CHARLESTON, S. C. • PASSAIC, N. J.

IT'S "PACKED WITH SATISFACTION" WHEN YOU USE R/M

Boiler Tubes

ANY SIZE—BENT OR STRAIGHT

This organization has the experience and facilities to meet your most exacting requirements. We can promise quick delivery on precision work, guaranteeing accuracy as to length and bend. Why not send that next order to "Boiler Tube?"

BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District)

PITTSBURGH • CHICAGO

FRED S. RENAULD & CO., LOS ANGELES

Best and latest methods of industrial water treatment

Here is a complete, up-to-date guide to the processes and apparatus for treating and purifying water. In it engineers, plant managers and other technical men will find the working knowledge they need to deal with any question or problem related to the provision of water for boiler feed or for special requirements of manufacturing. In simple terms and with many diagrams and photos, this book describes the construction and operation of the different types of filtering, softening and treating apparatus, and explains what chemical reactions take place in each treatment.

. . . including up-to-date information on—

HOW to prevent boiler embrittlement

HOW to speed up the lime - soda softening process

HOW to use chlorine for sterilization

HOW to prevent scale deposit in pipe lines

. . . and other practices

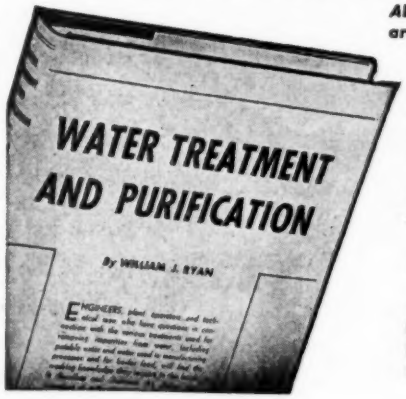
Just Published—New 2nd Edition

WATER TREATMENT AND PURIFICATION

By WILLIAM J. RYAN

270 pages, 5½ x 8, 66 diagrams and illustrations, $2.75

The facts about *all* the effective treatments for removing impurities from water are in this book—covering potable water and water used in manufacturing processes and for boiler feed. Now brought fully up-to-date, this new edition makes available the latest information on the use of sedimentation tanks, coagulation basins, chemical feeding, devices, filtration plants, softening apparatus, ion exchange apparatus, sterilization processes, etc. Special attention is given to the problems of treating boiler feed water.



ALL water treatment facts are in these 12 chapters:

1. The Impurities In Water
2. Sedimentation and Coagulation
3. Filtration
4. The Analysis of Water
5. The Lime and Soda-ash Process
6. Ion Exchangers
7. Boiler Feed - water Treatment — General Considerations
8. Boiler Feed - water Treatment—Methods Used
9. Disinfection of Water
10. Tastes and Odors
11. Miscellaneous Treatments
12. Prevention of Corrosion

EXAMINE 10 DAYS FREE—MAIL THIS COUPON

McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y.

Send me Ryan . . . Water Treatment and Purification for 10 days' examination on approval. In 10 days I will send $2.75 plus few cents postage or return book postpaid. (Postage paid on cash orders. Same return privilege.)

Name .....

Address .....

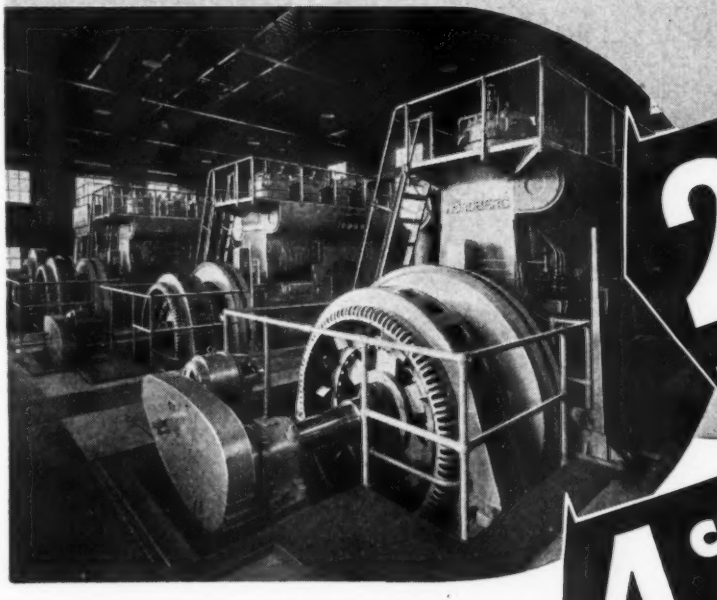
City and State .....

Position .....

Company P-3-47

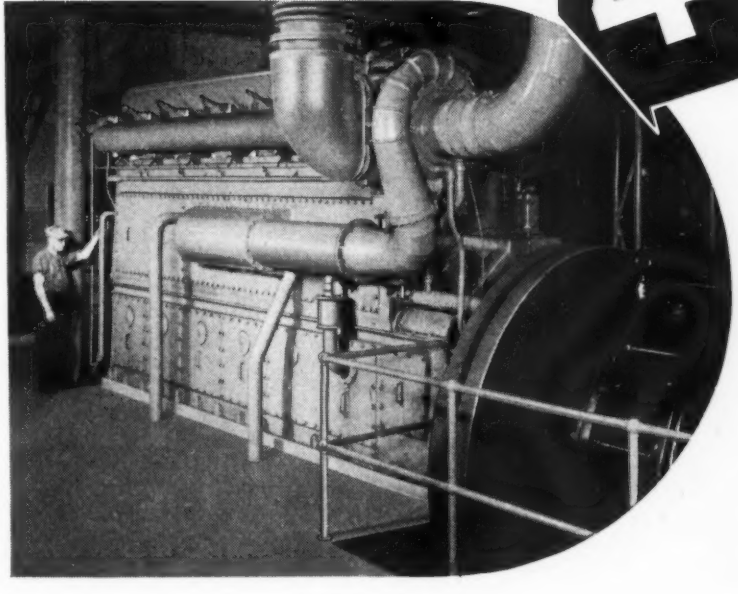
For Canadian price write Embassy Book Co., 12 Richmond St. E., Toronto 1

A NORDBERG DIESEL *will supply your power needs*



2 CYCLE ENGINES
Available in sizes up to 8500 B. H. P. in a single unit.

4 CYCLE ENGINES
Built in non-supercharged and supercharged designs in sizes up to 1600 B. H. P.



As a builder of both two and four-cycle oil or gas burning Diesel engines, Nordberg can supply the power needs of plants small and large and a type engine best suited to each requirement. Back of these engines is a record of many years of successful performance that has won for Nordberg a position of leadership in the Diesel power field. The many repeat orders from satisfied users attests to this fact. For dependable, low cost power, investigate the merits of Nordberg Diesels. Our engineers will gladly furnish further particulars on an engine to meet your power demands.

NORDBERG MFG. CO., Milwaukee 7, Wis.

NORDBERG MACHINERY

NORDBERG
DIESEL ENGINES

NORDBERG MACHINERY

GENERAL CONTROLS . . .
THE ACKNOWLEDGED STANDARD IN AUTOMATIC PRESSURE, TEMPERATURE AND FLOW CONTROL UNITS

Here are a few of an outstanding line of controls for Industrial, Commercial and Domestic applications.

★ALL-GAS CONTROLS
★AIRCRAFT CONTROLS, ELECTRIC
★AUTOMATIC SAFETY PILOTS
★GAS REGULATORS
★LOW WATER CONTROLS
★GOVERNOR TYPE VALVES
★HI-LOW OFF VALVES
★INDUSTRIAL VALVES
★LOW PRESSURE GAS VALVES
★MOTOR OPERATED VALVES
★MAGNETIC GAS VALVES
★PILOT BURNERS
★PILOT GENERATORS
★REFRIGERATION VALVES
★SOLENOID VALVES
★STRAINERS—RELAYS
★100% SHUT-OFF VALVES
★THERMOSTATIC CONTROLS
★TRANSFORMERS—SWITCHES
★THERMOVALVES

Controls for air, water, steam, natural, manufactured and liquefied petroleum gases, light and heavy oils, etc., refrigerants such as freon, methyl chloride, sulphur dioxide and ammonia.

A.C. or D.C., normally closed or open types. High and low pressures and temperatures PROVED AND IMPROVED PERFORMANCE IS PROOF THAT YOU CAN'T BUY BETTER CONTROLS

GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE 1, CALIF.
Manufacturers of Automatic Pressure, Temperature and Flow Controls
FACTORY BRANCHES AND DISTRIBUTORS IN PRINCIPAL CITIES

AS QUICK AS A FLASH YOU CAN KNOW THE EXACT MEASUREMENT OF YOUR VALUABLE STORED LIQUIDS With* LIQUIDOMETER *Tank Gauges

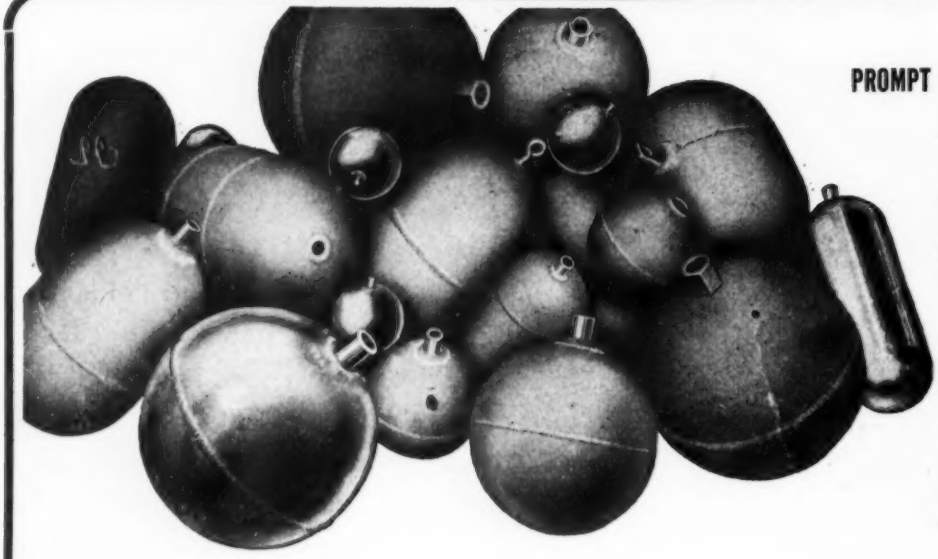
100% AUTOMATIC

APPROVED BY UNDERWRITERS' LABORATORIES

WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE **LIQUIDOMETER** CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, L.N.Y.



PROMPT DELIVERY OF FLOATS IN:

- **Types for external and internal pressure applications.**
- **10 Standard shapes.**
- **10 Standard connections.**
- **Metals: Steel with chromium, cadmium or copper plating; Stainless Steel; Monel.**
- **Sizes: 2" to 14" diam.**
- **Pressure to 3,000 lbs.**

Send for BULLETIN 746

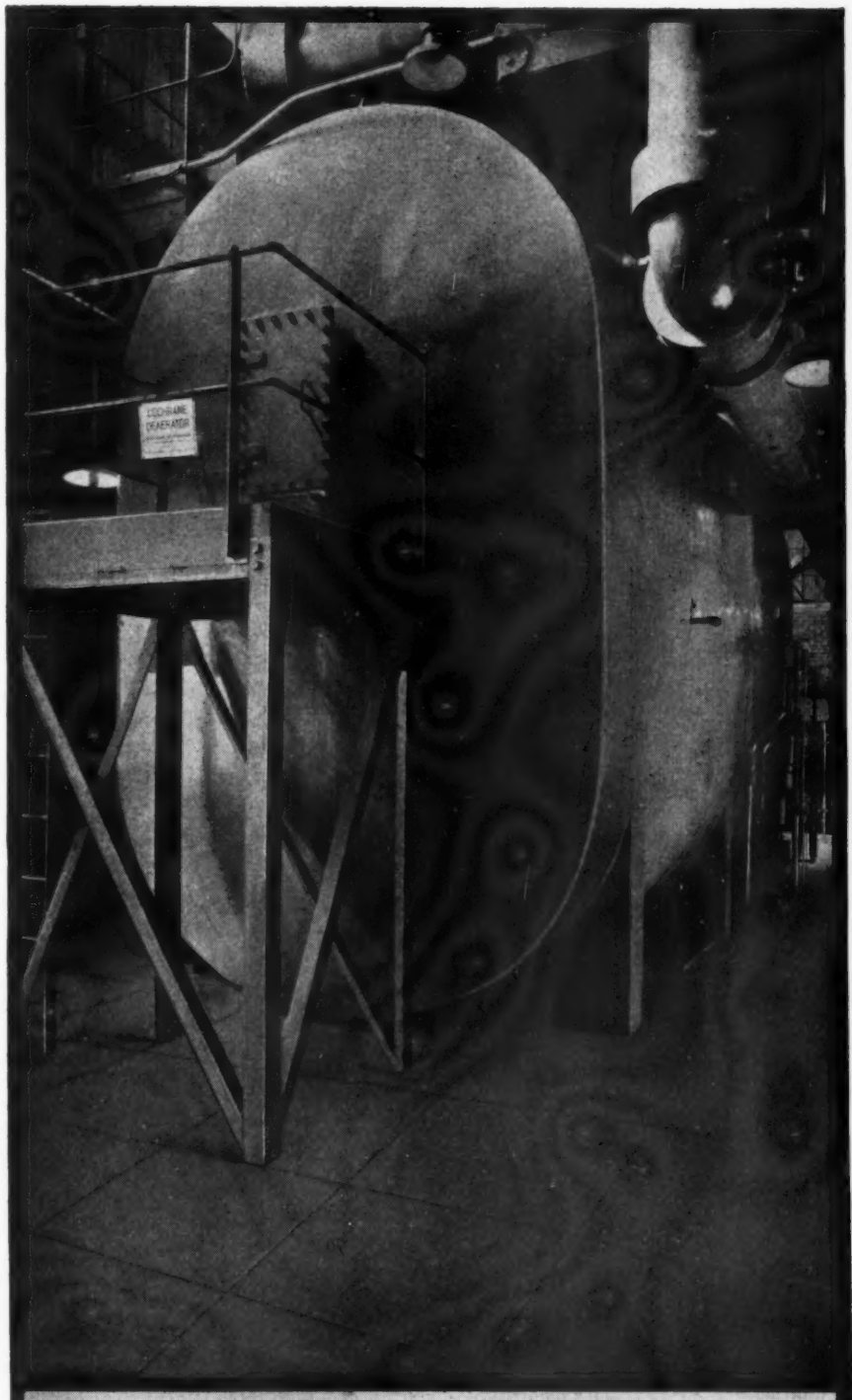
It's a helpful handbook for users of floats for operating mechanisms and as high-pressure storage vessels.

NICHOLSON FLOATS FOR EVERY PURPOSE

Adopted as Standard by Many Makers of Chemical, Refining, Food & Steam Equipment

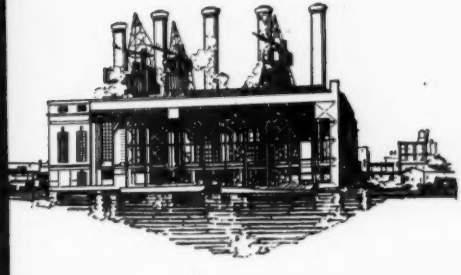
A pioneer of welded floats, Nicholson is today one of the nation's largest manufacturers. In a new plant, devoted to floats, we employ the latest methods in producing units for a wide range of metal, buoyancy and pressure requirements. Let us furnish details, showing why hundreds of manufacturers standardize on Nicholson floats.

W. H. NICHOLSON & CO. 125 OREGON STREET WILKES-BARRE, PA.
Valves ★ Traps ★ Steam Specialties



CRAMPED QUARTERS *for a* GIANT

Another problem solved by COCHRANE flexibility of design



AT Consolidated Edison's Hell Gate Station in New York, large capacity equipment was required for the deaeration of returned condensate, but space limitations would not permit conventional deaerator design. To Cochrane engineers, however, this was no unusual problem. Their solution was the elliptical rolled plate deaerator, shown above. Its capacity is nearly two million pounds per hour.

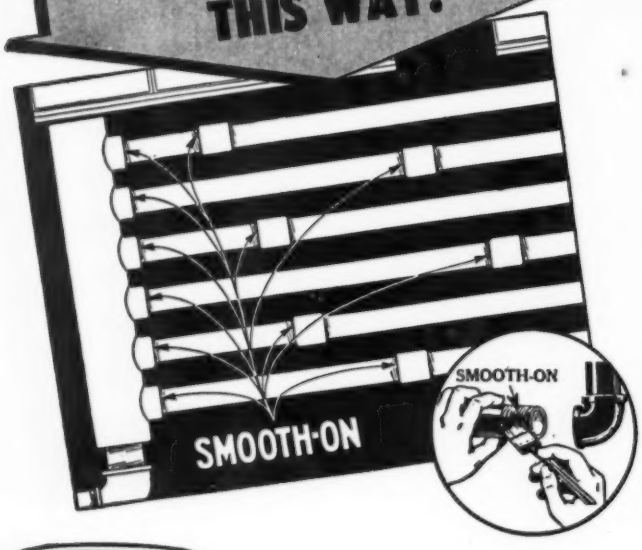
Cochrane has long been demonstrating, for public utilities and industrial plants of all sizes, its ability to solve unusual problems involving space, volume, heat balance, water conditions and other limiting factors affecting deaerating and softening equipment.

COCHRANE

DEAERATORS • SOFTENERS

COCHRANE CORPORATION · 3106 N. 17th STREET · PHILADELPHIA 32, PA.

INSURE TIGHT THREADED JOINTS THIS WAY:



Safeguard against leaks by using Smooth-On No. 3 Iron Cement in making any threaded joint. This soft metal cement does not blow out, shrink or shrivel under high temperatures and pressures. It is impervious to water, air, steam, gas and many chemicals.

Smooth-On No. 3 lubricates the threads in assembling, making a tight joint that may be taken apart when necessary. Equally effective for flanged and other thin joints, and for sealing rivets, seams and joints in plate metal.

Comes in paste form, ready to use. Buy Smooth-On No. 3 in 1-, 5- or 25-lb. size at your supply house. If they haven't it, write us.

FAMOUS REPAIR HANDBOOK FREE

Thousands of engineers, mechanics, repair and maintenance men have already sent for this helpful book, which shows many practical, tested, short-cut repairs on plant equipment. 40 pages. 170 diagrams. Send for YOUR free copy today.

PASTE THIS ON A POST CARD AND MAIL

Smooth-On Mfg. Co., Dept. 30C
570 Communipaw Avenue, Jersey City 4, N. J.

Please send me a Smooth-On Handbook

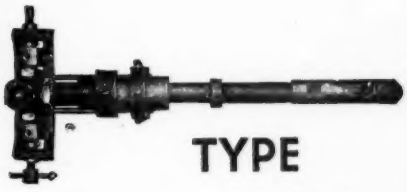
Name .....

Address .....

3-47 .....

Do it with **SMOOTH-ON**
The Iron Repair Cement of 1000 Uses

NATIONAL AIROIL FUEL OIL · GAS BURNERS



TYPE

"SAL"

OIL BURNERS

provide a reliable reserve *fuel system* in pulverized coal burning furnaces

Type "SAL" Steam Atomizing Oil Burners (in combination with most standard pulverized coal registers) are efficient supplementary or alternate units in dual fuel systems.

They assure 100% reserve fuel burning equipment for alternate use during coal shortages, disablement of, or repairs to coal handling equipment or during "banked fire" periods; provide inexpensive, safe ignition of cold furnaces preparatory to igniting pulverized coal; can be safely and dependably used to maintain combustion of the pulverized coal mixture; and permit quick changeover, from one fuel to the other, without shutdown . . . (thereby enabling you to take advantage of competitive price changes.)

Of distinct advantage, too, is the ability of the Type "SAL" Oil Burner to develop a sharp, steady, well-defined flame; to thoroughly atomize and completely burn the fuel oil; to reduce the tendency to smoke, form soot or incur carbon losses. Type "SAL" Oil Burners are large capacity burners with great flexibility over a wide operating range. Their application to dual fuel systems is described in Brochure #5, write for it.

NATIONAL AIROIL BURNER CO., INC.
Main Offices & Factory: 1250 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PA.
Texas Office: 2nd National Bank Bldg., Houston

Cutter head speed *is the pay-off*

TOP SPEED UNDER ACTUAL SERVICE CONDITIONS is the way to judge a tube cleaner's ability to do a faster cleaning job. Lagonda tube cleaners have this speed. Their cutter heads *keep on* whirling swiftly when heavy scale tries to slow them down.

POWER—LOTS OF IT—goes right along with these racing, driving cleaners. The Lagonda motor—whether water or air-steam type—is packed full of power—and with reserve battalions of it to jump in when the going gets heavy.

RUGGED CUTTER HEADS PLAY THEIR PART in these faster, more effective cleaners. They're designed and built with the finest materials, with cutters that hold their edges, and vital parts especially heat-treated to insure proper hardness so that they stand up under this extra operating speed and power. Trackless cutters insure against tube injury as well as positively removing every trace of scale.

Use Lagonda Cleaners for tubes stralght or curved, large or small. They do a faster, better, all-around job. The bulletin tells why—Write for it today.

ELLIOTT COMPANY
Lagonda Division, SPRINGFIELD, O.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

Lagonda TUBE CLEANERS

Y-265

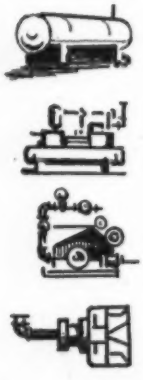
Keep Fuel Oil Tanks, Pumps, Pipe Lines and Burners free of sludge . . . resist rust and corrosion with—

WILCOLENE

Reg. U. S. Pat. Office

The tried and proved

FUEL OIL TREATMENT



WILCOLENE is making substantial savings in fuel oil, power and maintenance in many nationally-known industrial plants. Added in small quantities to fuel oil, it dissolves sludge, gum and tar, keeping it in suspension for burning as fuel. It is harmless to all metals and refractories.

Fuel Oil Treatment with WILCOLENE will dissolve existing sludge and reduce its formation. It resists rust and corrosion, keeps burners free and clear, and causes oil to flow more freely thereby reducing pump load. By conditioning sludge for burning, WILCOLENE turns waste into a useful, combustible product and reduces oil consumption.

It is proved successful treatment for Bunker C, Navy Special or Diesel Fuel Oils. It is guaranteed to perform as claimed.

Write today for further details.

Agencies Available in Principal Cities

WILCOLENE MFG. CO.

200 WEST 72nd STREET, NEW YORK 23, N. Y.

Heavy Duty Plastic Makes

SOLID FLOOR PATCH

INSTANTLY...No Wait for Setting!

FREE TRIAL OFFER

Tamp Smooth! Truck Over!

Now you can restore broken concrete to solid smoothness without having to close off the area. Use durable INSTANT-USE . . . a tough, plastic material which you simply shovel into hole—tamp—and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

Request Descriptive Folder and Details of

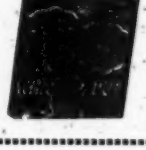
FREE TRIAL OFFER

INSTANT-USE

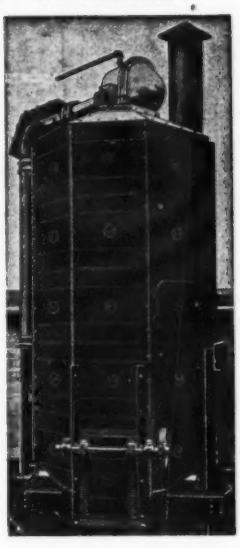
FLEXROCK COMPANY
3677 Filbert St., Philadelphia 4, Pa.
Canadian Office: 21 King St., E, Toronto, Ont.

Please send me complete INSTANT-USE information and details of TRIAL ORDER PLAN—no obligation.

Name .....
Company .....
Address .....



PIPE-LINE or PNEUMATIC CONVEYORS for ASHES and FLY-ASH



"Most economical in steam-consumption and maintenance." Design of every part, fitting, etc., based on our experience of 25 years with the successful manufacture and operation of these types of conveyors and on our full appreciation of their special requirements.

We also specialize in improving existing conveyors through our superior fittings and frequently through rearrangement of present layouts.

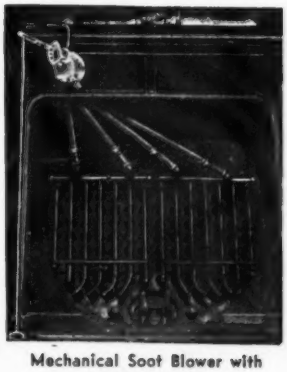
CAST IRON SECTIONAL ASH TANKS, COAL BUNKERS, BINS, HOPPERS and SILOS

Octagonal | Oblong-Octagonal | Semi-Octagonal

Durability combined with our exclusive discharge-efficient and self-clearing designs, preventing arching, packing and spontaneous combustion in case of coal bunkers and also obviating the necessity of hazardous trimming.

MECHANICAL SOOT BLOWERS for FIRE-TUBE BOILERS of ALL TYPES

Fixed nozzle centered to each tube. No cutting of tube-sheet. No moving parts in hot boiler. All tubes in boiler blown with four successive puffs of steam or air in about one minute. Perfect soot-removal from each tube END TO END.



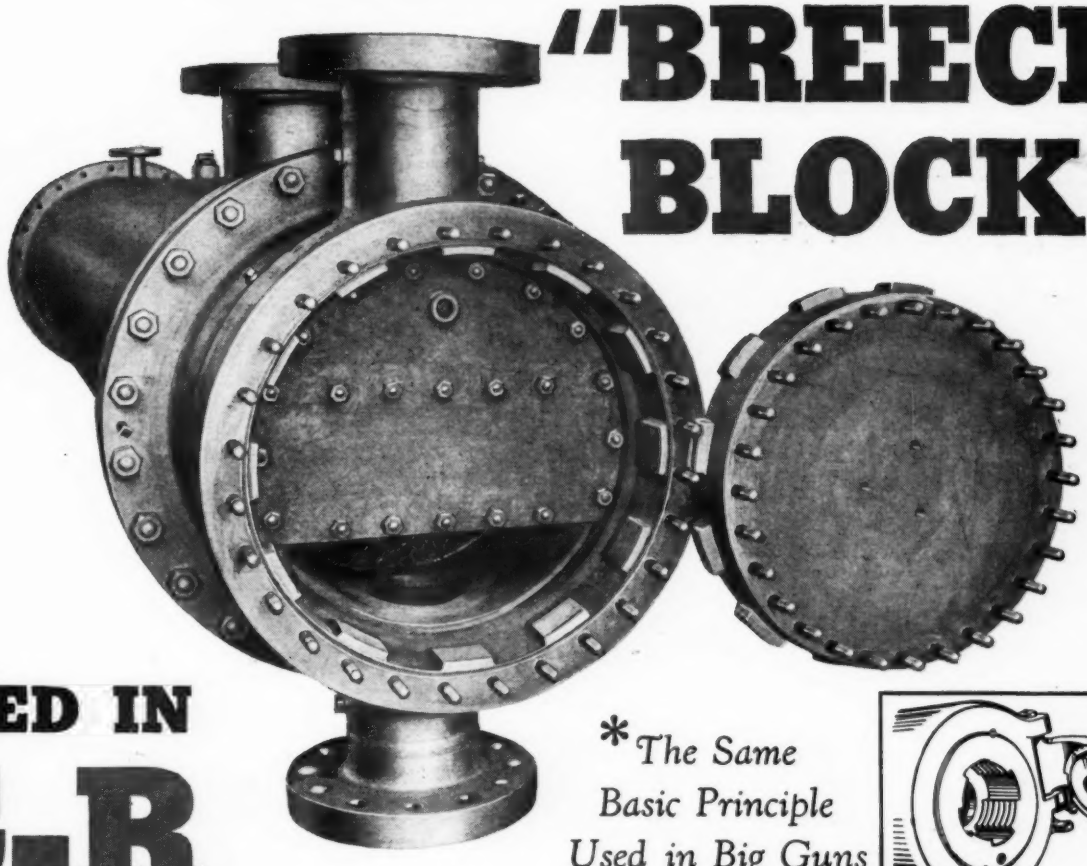
Mechanical Soot Blower with H. R. T. Boiler

HAHN EQUIPMENT CORPORATION

(Formerly Hahn Engineering Co.)

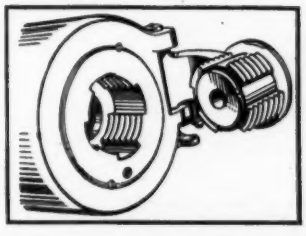
30 CHURCH STREET, NEW YORK 7, N. Y.

"BREECH BLOCK*"



USED IN G-R HIGH PRESSURE BLEEDER HEATERS

*The Same Basic Principle Used in Big Guns



NOTE THESE ADDITIONAL G-R BLEEDER HEATER FEATURES

•

PARTITION SEALING PLATES

. . . prevent leakage between passes at the water heads without requiring stay bolts.

•

ENVELOPING STEAM BAFFLE

. . . permits water outlet temperatures beyond saturated steam supply—when sufficient superheat is available.

•

TUBE JOINTS

carefully prepared and controlled, assuring lasting tightness of the tube ends in the tube sheets.

The effectiveness of this simple arrangement is known to every one who has seen a big gun fired.

In the G-R Type L Bleeder Heater this design of waterhead cover has important advantages:

• The inner circumference of the head and the periphery of the cover have projections of corresponding size. When the cover is inserted and revolved a few inches, these projections engage with each other so as to lock the cover in place. The hydraulic load is carried in this manner.

• The pressure-sealing gasket is *outside* of the cover . . . located where any seepage is immediately visible, and accessible for tightening without dismantling or disturbing the waterhead cover.

• At the floating head, a shell test pressure can be applied without fear of gasket failure.

This exclusive seal and the many other special features of G-R Bleeder Heaters warrant your further investigation. Write for Bulletin 278 describing these units in detail.

THE GRISCOM-RUSSELL CO.
285 Madison Ave., New York 17, N. Y.

GR-187

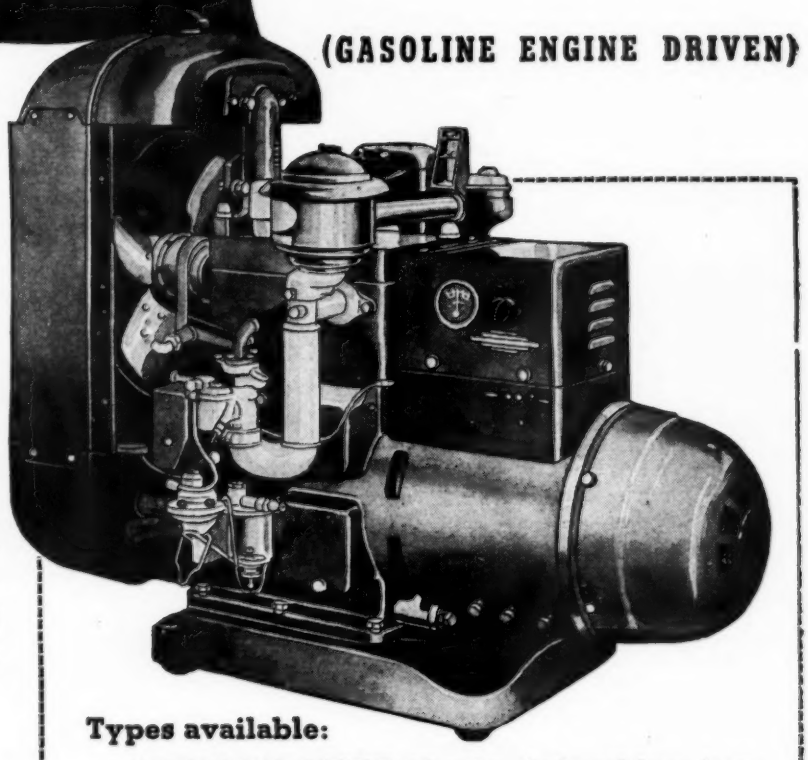
GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

Everything Electrified with

PORTABLE GENERATORS

(GASOLINE ENGINE DRIVEN)



Low WAA prices make these sturdy, all-purpose portable electric power units practical for use on jobs which have never before justified expensive equipment. Today these generator sets, designed and built for heavy duty work, are for the first time cheap enough to use for unusual jobs in out of the way places. Decide now where you can use one or more—and act immediately to take full advantage of these remarkable prices.

☆ ☆ ☆

Larger sizes can be adapted for use of natural gas fuel, other sizes are valuable for:

Stand-by Units	**Summer Camps**
Small Machine Shops	**Trailer Camps**
Saw Mills	**Carnivals and Fairs**
Radio Stations	**Mobile Power Units**
Rural and Farm Installations	**Construction Jobs**

☆ ☆ ☆

See our display booth at the Western Metal Exposition and Congress Show at Oakland, California, March 22 to 27, 1947

Types available:

ALTERNATING CURRENT: 60 cycles, single and three phase, 120-480 volts, 1½ kva. and up, priced from $250 up.

DIRECT CURRENT: 24, 110, 220 volts, ¼ to 40 KW, priced from $80 up.

All generators are sold under existing priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area, and then to purchase the materials offered herein.

EXPORTERS: Your business is solicited. If sales are conducted at various levels you will be considered as a wholesaler. Any inquiries regarding export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.

OFFICE OF GENERAL DISPOSAL

WAR ASSETS ADMINISTRATION

GOVERNMENT WAA SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia Portland, Ore. • Richmond • Salt Lake City • St. Louis • San Antonio • San Francisco • Seattle • Spokane • Tulsa

824-2

SUPER EXCELO
REPUBLIC RUBBER DIV.
YOUNGSTOWN OHIO U.S.A.
CHALLENGER
CHALLENGER
CHALLENGER
YOUR BELTING & HOSE NEEDS ARE Special NEEDS TO R·E·P·U·B·L·I·C
● Even in the most general types of service for mechanical rubber belting and hose, operating conditions of one plant vary from those of another. And rubber products must be exactly suited to the specific working conditions to attain the goal of all such equipment—longest service life. That is why Republic technologists consider each application a special case, specify rubber and reinforcing components according to the requirements. When the Republic belt or hose goes to work, it has properties of resistance to every form of abuse known to exist in the intended service. This specialized attention to your needs begins when you call in your nearby Republic Distributor.
MORE SERVICE FROM RUBBER FOR INDUSTRY
REPUBLIC RUBBER
DIVISION
LEE RUBBER & TIRE CORPORATION
YOUNGSTOWN 1, OHIO
REPUBLIC INDUSTRIAL PRODUCTS
YOUNGSTOWN O
LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA.
REPUBLIC RUBBER
TARGET
SUCTION
REPUBLIC RUBBER
TONKA
YOUNGSTOWN, OHIO
REPUBLIC RUBBER
TOWER PNEUMATIC
OIL RESISTING TUBE
YOUNGSTOWN, OHIO

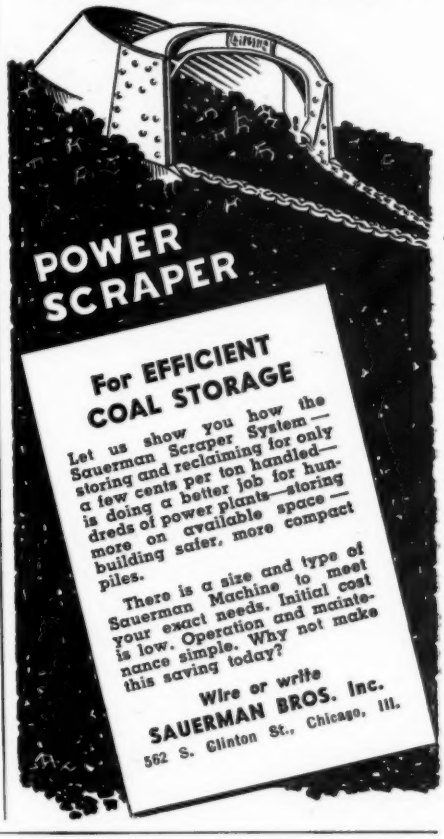
Use
THE GENUINE
Squires
REDUCING VALVES
for dead - end service, or wherever close regulation is required.

Also Steam and Air Traps, Pump Governors and Boiler Feed Water Controllers.

THE C. E. SQUIRES CO.
E. 40th St. and Kelley Ave. Cleveland, O.

For All the News in the Power Field Read Power Every Month

Spend Less To Store More!
WITH A SAUERMAN



For EFFICIENT COAL STORAGE

Let us show you how the Sauerman Scraper System—storing and reclaiming for only a few cents per ton handled—is doing a better job for hundreds of power plants—storing more on available space—building safer, more compact piles.

There is a size and type of Sauerman Machine to meet your exact needs. Initial cost is low. Operation and maintenance simple. Why not make this saving today?

Wire or write
SAUERMAN BROS. Inc.
562 S. Clinton St., Chicago, Ill.

FOR SAFETY
STRENGTH
DURABILITY

. . . use HENDRICK MITCO
OPEN STEEL FLOORING

The square-edge, uniformly spaced metal bars provide a non-slipping surface; the rectangular spacings and 90% open area permit maximum lighting and ventilation.

Of pressure formed construction, there are no welds to weaken, no rivets to loosen, no bolts to rust—no dirt-catching nor light-obstructing projections.

Every Mitco panel is a strong, integral unit, capable of supporting heavy loads without lateral deflection.

Send details of area to be covered, giving size, type and location of supports, and Hendrick will submit Mitco recommendations—without obligation. Write for complete information.

SEE OUR CATALOG IN SWEET'S

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

HENDRICK
Manufacturing Company
46 DUNDAFF STREET, CARBONDALE, PENNA.
Sales Offices In Principal Cities

New 2½" to 4" GEARED PIPE THREADER

that's a cinch to work with RIDGID No. 4P

Loop handles make it easy to pick up

easy to carry

easy to put on pipe

● You can't make a big die stock like this out of marshmallow just to keep it light weight. This new RIDGID 4P is husky all steel-and-malleable but those sensible balanced loop handles enable you to use it without breaking your back; even when it's greasy and you're tired, you swing it into action easily, smartly — straight on the pipe, no struggle, no slipping or tipping.

Quick-Setting Workholder

Mistake-proof plate type, sets to size *before* you put it on pipe. One screw to tighten, no bushings to bother with.

Less-Effort Pipe Threading

Smooth accurate threads easily cut with 4 sets of 5 dies, standard or tapered, drip threads, short nipples. Ratchet handle equipped, RIDGID power universal drive shaft available.

Almost No Upkeep

Twin-anchored pinion turns in oilless bronze bearing — never needs oil. Grease packed gear fully enclosed, safe for you, safe from dirt and wear.

To save yourself work and muscle-fag and get perfect 2½" to 4" threads, order the efficient new 4P — at your Supply House.

RIDGID **WORK-SAVER PIPE TOOLS**

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

Low W A A PRICES MEAN *Extra* PROFITS

The War Assets Administration is today the world's largest single supplier of valves and fittings. For instance, you can buy those hard-to-come-by valves and fittings for water, oil and steam lines from *any* WAA Regional Office and, more important, you can get delivery NOW. Prices are so low that extra profits are practically assured either on re-sales or installation jobs. Purchases must total $300 or more. All items offered subject to prior sale.

Valve sizes: ½" to 24"
Fittings sizes: ¼" to 36"
Pressure ranges: 100 lbs. p.s.i. to 3000 lbs. p.s.i.

While every Regional Office has a supply of valves and pipe fittings, the largest inventories are located in these cities:

Atlanta	San Francisco
Birmingham	Portland, Oregon
Boston	Nashville
Chicago	Philadelphia
Cincinnati	New York

All valves and fittings are sold under existing priority regulations of WAA and of the National Housing Expediter. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area, and then to purchase the materials offered herein.

EXPORTERS: Your business is solicited. If sales are conducted at various levels you will be considered as a wholesaler. Any inquiries regarding export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.

See our display booth at Western Metal Exposition and Congress Show at Oakland, California, March 22 to 27, 1947.

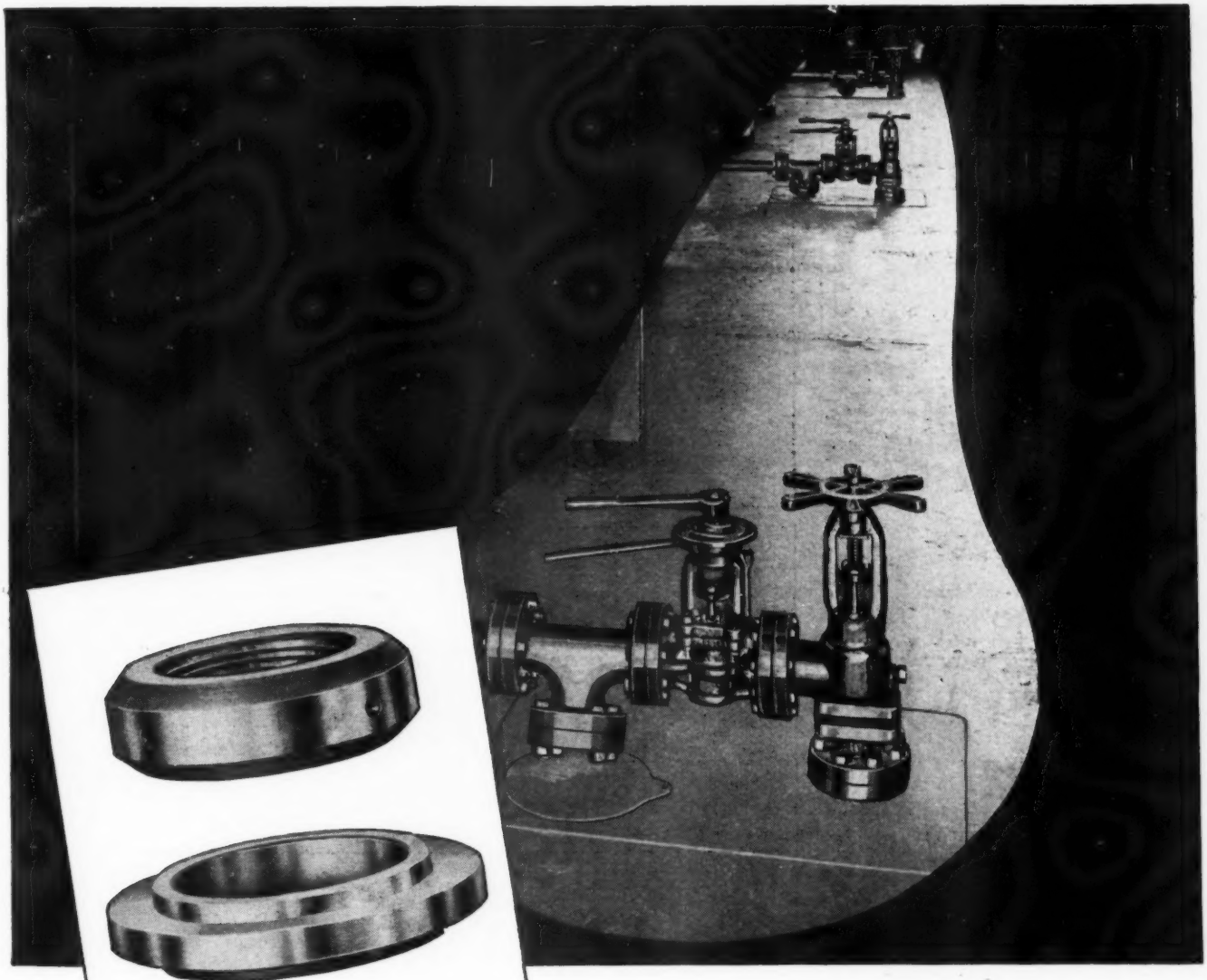
OFFICE OF GENERAL DISPOSAL

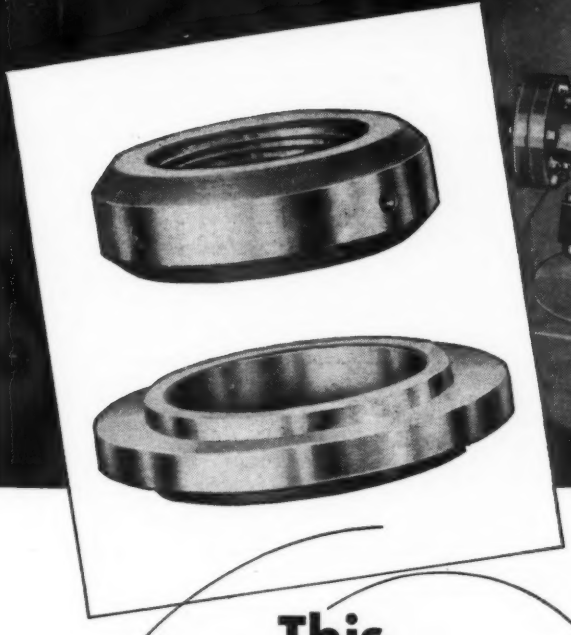
WAR ASSETS ADMINISTRATION

GOVERNMENT WAA SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

827-3





This

REVERSIBLE SEAT

means

DOUBLE VALVE LIFE

and 30% to 60% LESS MAINTENANCE EXPENSE

HOVALCO HOMESTEAD COMBINATION BLOW-OFF VALVES are built to outlast the boiler. Records of 25 to 30 years continuous use in boiler blow-off service are not uncommon. And not only do they have double the life span of ordinary valves, but they cost 30% to 60% less to maintain.

The HOVALCO ANGLE VALVE which takes all of the abuse and regulates the flow, is equipped with a special *reversible,* long wearing, "S" Monel seat and disc which is actually an "extra" set of accurately ground, perfectly matched seating surfaces ready to be put into service whenever the need arises. By simply unbolting the lower valve body and turning over the seat and disc, you have a good-as-new valve ready for another long lifetime of service.

Used in combination with HOMESTEAD LEVER-SEALD or CAM-SEALD QUARTER-TURN VALVES, they meet A.S.M.E. requirements and all state laws for boiler blow-off service.

We can furnish them in sizes 1½", 2" and 2½" for pressures to 600 pounds. Further detailed information and Valve Reference Book No. 38 will be mailed on request.

HOMESTEAD VALVE MANUFACTURING COMPANY

P. O. Box 210 **Coraopolis, Pa.**

WHERE TO BUY

Featuring additional products, specialties & services for power plants

MORPHOLINE is the Answer

. . . TO STEAM CONDENSATE RETURN LINE CORROSION

Avoid costly maintenance due to corrosion in lines returning condensed steam to the boiler! Morpholine effectively combats corrosion due to carbon dioxide dissolved in condensate. For information on this money-saving corrosion inhibitor, write Dept. M-1,

Carbide and Carbon Chemicals Corporation
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.

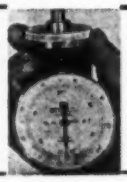
TEST SPEEDS and SAVE at a glance
REVOLUTIONS and FEET per min.
SPEED VARIATIONS
BELT CLIPPAGE
Send for Bulletin
O-Z Improved Hand Tachometer-Cutmeter
O. ZERNICKOW CO.
21 Park Row New York

End Pump Troubles!
HILL IMPROVED PUMP VALVES

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate. Send today for bulletin that tells how to get better pump performance.

HILL PUMP VALVE CO.
2728 ELSTON AVE. CHICAGO 47, ILL.

COATS TACHOMETERS
5-Range Centrifugal
prevent overloading or operation below peak.
Bulletin #8889.
Coats Machine Tool Co.
Tudor Dr. Scarsdale, N. Y.



PROFESSIONAL SERVICES

ASSOCIATED ENGINEERS, Inc.
Joseph C. Lewis, *President*
Management Consultants
Engineering . . Architecture . . Accounting
Organization . . Methods . . Costs
230 E. Berry St., Fort Wayne 2, Ind.

REYNOLDS, SMITH AND HILLS
ENGINEERING CONSULTANTS
Specialists in Design and Construction of Industrial and Central Station Plants
Reports, Analyses and Surveys
10 South Laura St. Jacksonville, Fla.

ELECTRIC CONSTRUCTION COMPANY
Engineers—Contractors
Design—Erection—Maintenance of
Power Plant, Sub Stations
Transmission and Distribution Lines
Modern Equipment
Philadelphia, Pa.

SANDERSON & PORTER
ENGINEERS
AND
CONSTRUCTORS

E. R. GARLOCK & ASSOCIATES INC.
Industrial, Mechanical & Electrical Maintenance Engineers
Complete plant and power maintenance, rehabilitation, installation, construction, inspection, performance and efficiency supervision.—Emergency repairs. High pressure power units a specialty.
261-202 Delaware Bldg. Akron 8, Ohio

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St. Chicago, Illinois

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Industrial and Utilities
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examinations—Laboratory
61 Broadway New York
147 K St. N.W. Washington, D. C.
17 & Sansom St., Phila., Pa.

J. E. SIRRINE COMPANY
Engineers
Power Plants Consultation
Design Reports
Water Steam Utilization Plans
Greenville South Carolina

HALL LABORATORIES, Inc.
R. H. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
Hagan Building Pittsburgh (30), Pa.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg. Muscatine, Ia.

KEGARISE - CRONK ENGINEERING CORP.
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Steam and Electric Utilization
Design — Reports — Plans
334 E. Main St. *P. O. Box* 668 Johnson City, Tenn.

JOHN A. STEVENS INC.
Established 1909
CONSULTING ENGINEERS
Power Plants Paper Mills
Dye Houses Surveys
Lowell, Massachusetts

T. MASENG & ASSOCIATES
Engineers
Electrical, Design Structural, Reports Mechanical Rates
343 So. Dearborn Chicago 4, Ill.

SYSKA & HENNESSY
Engineers
Consultation Plans Reports
Power Plants Disposal Plants
Water Systems
144 East 39th Street
New York, New York

LUKE L. NAKASHIAN
Engineer
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINERY EQUIPMENT
404 Park Square Building. Boston 16, Mass.

THE J. G. WHITE ENGINEERING CORPORATION
Design. Construction . Reports. Appraisals
80 Broad Street, New York 4

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEER
Design Operations
Steam - Hydro - Gas
231 S. LaSalle St. Chicago (4), Ill.

WHITMAN, REQUARDT AND ASSOCIATES
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md.

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

CORROSION—And What You Can Do About It

Extending Condenser Tube Life

Corrosion is to metals what rotting is to wood. Destruction from corrosion is so great and widespread that the annual damage is estimated in billions of dollars. A knowledge of the nature of corrosion can be helpful in extending the life of condenser and heat exchanger tubing, pipe lines, etc. Briefly, corrosion is the reverse of metal refining.

Because metals are not permanently stable, the war of corrosion goes on all the time. Some metals are more susceptible than others. Under most conditions they tend to revert to compounds similar to the metallic ores from which they originated. Moisture or water solutions accelerate this reaction. This explains why tubing, in condensers, heat exchangers, and evaporators which handle different kinds of water and industrial solutions or liquors, is subject to corrosion.

Corrosion Process is Complicated

In order to understand the cause of corrosion it has been necessary to conduct intensive research for many years by top-flight metallurgists and chemists. It is much more complicated than the simple explanations which one often hears.

A popular misconception of the cause of pitting of Admiralty condenser tubing is that the alloy (approximately 70% copper, 29% zinc and 1% tin), as a result of improper casting, contains particles of zinc scattered throughout the metal. According to this idea, the sea water tends to dissolve the zinc particles much more readily than the brass itself. Consequently, the tube becomes riddled with holes where zinc spots formerly existed. This is contrary to all scientific observation, since zinc spots are never found in brass even when viewed with the most modern microscope under the highest magnification. On the other hand, scientific explanations involve technical terms, equations and electro-chemical theories which are not easily understood by the layman.

Corrosion Films a Leading Factor

When the corrosive medium comes in contact with the metal surface, various reactions occur, producing metal salts as products of corrosion. These form a film which may or may not be of a highly protective nature. If the film is dense, tough and adherent, the rate of corrosive attack is slowed down and the film is thought of as being protective. If the film lacks density and adherence and is readily permeable it may not be very protective.

If the protective film is abraded mechanically so that areas of the metal are again exposed to the action of the corroding medium, rapid reaction again takes place until the film is re-established. The rate of corrosion of various metals and alloys is largely a matter of the differences between the films that are formed during corrosion and the rates at which these films are formed and re-established after damage. Corrosive attack starts at the weakest point in the film. Scratches and surfaces under porous deposits are among the points susceptible to attack. This suggests that it is desirable to maintain clean, smooth, undistorted metal surfaces.

Injury to Protective Film Should be Avoided

Protective films on condenser tubes can be injured through abrasion from the sharp edges of sand, cinders, shells and other debris. They can also be penetrated by impinging streams of water. The presence of air bubbles in the water has an additional effect in speeding up the rate of corrosion. It has been shown that the films which develop on different alloys vary in their resistance to impingement attack.

It is obvious from the above that tube life can be extended by preventing the presence of such attacking elements as abrasive materials and excessive turbulence.

Nature of Film Varies

Metals also vary in their ability to repair films which have been broken. For example, it has been shown that the protective film formed on aluminum brass is repaired more readily when broken than the protective film formed on Admiralty. Because the most highly protective films are often thin and invisible, their presence and importance were slow in being recognized.

Temperature and Water Composition Important Factors

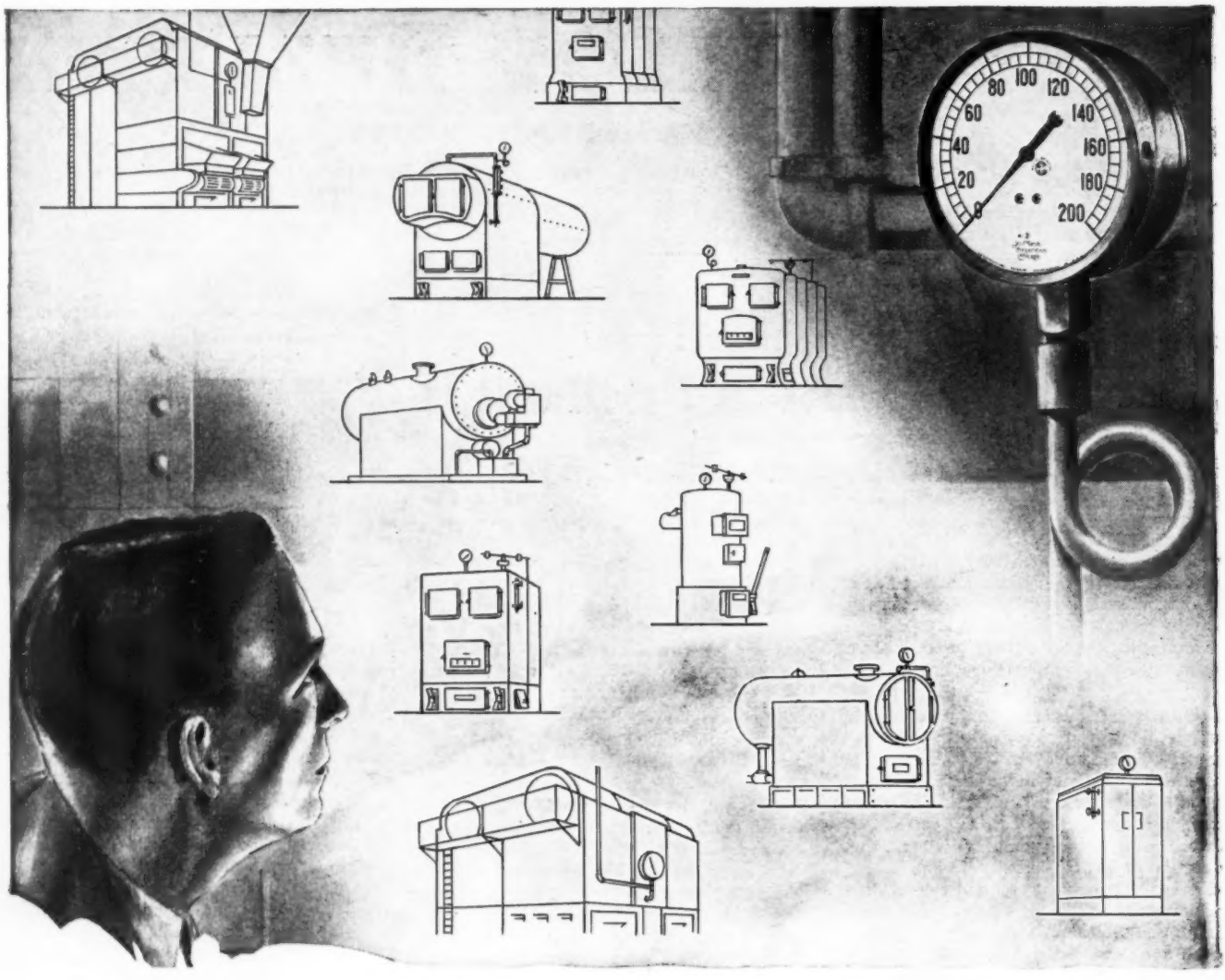
Rate of penetration of the protective film is largely dependent upon the composition and temperature of the water. Heat accelerates practically all the reactions involved in the mechanism of corrosion. The higher temperatures of cooling waters during the summer is one of the factors contributing to more rapid corrosion during that season. In some cases, new condenser tubes, installed during the winter season, have given longer service than those installed during the summer.

Temperature may affect water composition by increasing the bacterial activity which, when high, affects the development of methane, ammonia, carbon dioxide. hydrogen sulphide, etc., in the water. Carbon dioxide and hydrogen sulphide may be formed in sufficient concentration to have a marked corrosive action. Hydrogen sulphide gas may destroy the protective film built up during the cooler months when the water composition is more nearly normal. The effect of temperature on corrosion and tube life was described in some detail in the August and September, 1945, issues of the Marine and Power Copper Alloy Bulletin. Extra copies will be furnished upon request. A further discussion on corrosion will be given in future issues of the bulletin. In the meantime, write for your copy of the Condenser Tube Manual, which contains many interesting facts about corrosion, alloy composition, specifications and valuable tables. Experienced men are available to help select the tube alloy which will best serve specific conditions.

With the many thousands of condensers and heat exchangers in operation throughout the land and at sea, a wealth of experience has been built up, thanks to the contributions by the many readers of this bulletin. We continue to welcome your letters and will be glad to hear about interesting and unusual facts and experiences. Our laboratory will also try to interpret any baffling tube failures. Address your letters to the Copper Alloy Bulletin, c/o Bridgeport Brass Company, Bridgeport, Connecticut.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*



. . . *Way out in front in the boiler field*

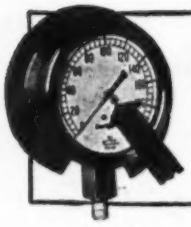
● Yes, a large majority of boiler manufacturers use Marsh pressure gauges. Marsh is out in front in every branch of this big industry—low pressure, high pressure, cast iron, fire tube, self-contained, water tube—from the smallest up to the largest.

In current trade directories, more than 65% of the boiler manufacturers listed equip their product with Marsh Gauges; and while actual boiler production figures are not available, this particular 65% of the boiler manufacturers unquestionably do, by the most conservative estimate, over 80% of the world's boiler business!

Here is a remarkable tribute to the lasting accuracy of Marsh instruments by men who use gauges in large quantities—men who know pressure gauges forward and backward. Yet it is only one example of the preference shown in many fields by manufacturers of products in which accurate pressure indication is vital.*

Keep this in mind when you buy pressure gauges. Use the instruments that are preferred by the most discriminative users of pressure gauges . . . *Marsh.*

Jas. P. Marsh products include: A full line and range of gauges in pressure, compound, altitude, hydraulic, sprinkler, ammonia, ounce-graduated retard, test, and diaphragm types. Dial thermometers in rigid stem and remote reading types. A broad line of steam and hot water heating specialties. Ask for literature.



MARSH ALONE HAS THE "RECALIBRATOR"—quickest and best way to correct a gauge that has been knocked out of adjustment by improper handling.

JAS. P. MARSH CORPORATION
2025 Southport Avenue, Chicago 14, Illinois

MARSH GAUGES

"THE STANDARD OF ACCURACY"

* Subsequent advertisements will cite additional examples of this.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
(Not available for equipment advertising)
90 cents per line, minimum 4 lines. To figure advance payment count 6 average words as a line and allow 10 words for a publication box number address.
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line insertion.

INFORMATION:
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
This advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. P.

NEW ADVERTISEMENTS received by March 11th will appear in the April issue, subject to limitation of space available

POSITIONS VACANT

(Additional Position Vacant ads on page 296)

ELECTRICAL ENGINEERS experienced in design of substations, power plants or overhead and underground distribution systems. Desirable living conditions in fine home community. Write to Electrical Engineer, Pennsylvania Power & Light Co., Allentown, Pa.

MECHANICAL ENGINEER Wanted: several years experience in Power Plant Maintenance and operation; age 30 to 40; Pacific Southwest; permanent; expanding community. Address replies to P-249, Power, 68 Post Street, San Francisco 4, Cal.

POWER PLANT Engineer Wanted—Large independent oil company wants engineer qualified to assume full responsibility for design-estimates and supervision of installation of oil burners and auxiliary equipment in new and reconversion jobs. Must be thoroughly experienced and have a practical background. Sales as well as engineering ability desirable. Write fully giving complete background and personal references, stating previous earning capacity and salary expected. Location Cleveland. P-262, Power, 520 N. Michigan Ave., Chicago 11, Ill.

DISTRICT SALES MANAGER for Industrial oil-fired heating and power equipment. Successful experience in sales, engineering and business management required. P-263, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED. LICENSED steam engineer capable of operating reciprocating engines and steam turbines. P-265, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: MAINTENANCE Supervisor to conduct repair work in two steam electric power plants developing 200,000 KW; age 30-45; must be familiar with maintenance of turbines, oil fired boilers and auxiliary equipment; locate Southern California. Address replies to P-266, Power, 68 Post Street, San Francisco 4, Cal.

To EMPLOYERS who advertise for MEN:

Frequently, when there are many applicants for a position, only the most promising letters are acknowledged. The other applicants never know whether their letters reached a prospective employer or not. These men often become discouraged, will not respond to future advertisements and even question their bona fide character.

Every advertisement printed in the Searchlight Section is duly authorized.

You can help keep our readers interested and get better returns to your advertising in this section if you acknowledge each reply—in plain envelopes, if you wish.

Classified Advertising Division

McGRAW-HILL PUBLISHING COMPANY, INC.

"Put yourself in his place."

WANTED

POWER ENGINEER

Large glass manufacturing company located Middle West needs man experienced in steam power, coal, oil, and gas fired equipment and accessories. Should know combustion theory and practice, operating costs, and be able to prepare operating budgets.

Give complete details of personal qualifications, age, work history, and salary expected in application.

P-259, Power
520 North Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEERS
WITH 5 TO 15 YEARS EXPERIENCE
In Design of Steam Electric Generating Stations or Gas Plants
Write to
MECHANICAL ENGINEER
PENNSYLVANIA POWER & LIGHT CO.
Allentown, Pa.

WANTED

ANALYTICAL CHEMIST

With Power Plant experience. Take charge main laboratory New York City. Nationally known water conditioning company. Supervise Analytical work and prepare surveys for clients. Give full information and state salary requirements.

Box 562, 159 E. 34 St., N. Y.

POSITIONS VACANT

MECHANICAL ENGINEER experienced in selling pumping machinery to become District Representative in charge of our New York office. Salary plus commission. Opportunity for excellent earnings to qualified man. Write giving full experience history. Confidential. Dean Hill Pump Co., 4000 E. 16th St., Indianapolis 7, Indiana.

PLANT CHIEF Engineer—Good position is open for steam power plant chief engineer with electric utility in Middle West. Position requires qualifications for complete supervision of plant with 38,000 kw. installed capacity. Permanent position with a company that is growing. Plant has good personnel and is in good operating condition. Promotion of present chief engineer makes this vacancy available. Outline education and experience. P-264, Power, 520 N. Michigan Ave., Chicago 11, Ill.

SELLING OPPORTUNITIES OFFERED

REPRESENTATIVE WANTED. Established Manufacturers of Industrial and Commercial Chain Grate Stokers and Grates for all solid fuels, wants sales representatives in: New England, New York, New Jersey, Western Penna., Ohio, Chicago area, St. Louis area, South Atlantic States, most States West of Miss. RW-256, Power, 330 W. 42nd St., New York 18, N. Y.

WE WISH to add several mature, experienced sales engineers (graduate mechanical, chemical, or civil) to our field staff. We manufacture a heavy industrial specialty, frequently designed to order. It is sold throughout industry. The men selected will spend several months in New York in training and will then be assigned to a territory to assist an elder salesman. Then, depending upon their development, they will be assigned a territory of their own. This is an unusual opportunity for men who are good engineers, resourceful and hard-working. Send full educational and business history to: SW-261, Power, 330 W. 42nd St., New York 18, N. Y.

SELLING OPPORTUNITIES OFFERED

SALES ENGINEER wanted for New York district. Age between 28 and 35, technical graduate, knowledge of power plants essential, selling experience preferred. Fine opportunity for man with right qualifications. Kindly send full information on education and experience. All communications will be treated confidentially. SW-267, Power, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICES

SALARIED POSITION $2,500 - $25,000. This thoroughly organized confidential service of 37 years recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000 - $25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 109 Church Street, New Haven, Conn.

POSITIONS WANTED

CHIEF ENGINEER—Municipal or Industrial plant. 15 years experience power plant maintenance and operation. 6 years of Erection and repair of Turbo-generators and reduction gears. Desire permanent location in west or southwest. 37 years of age and married. PW-270, Power, 520 N. Michigan Ave., Chicago 11, Ill.

MARINE ENGINEER, 30, married. New Jersey State Steam and Refrigeration licenses. Desires permanent position in power plant and Stationary Engineer, with opportunity for advancement. Any location. PW-268, Power, 330 W. 42nd St., New York 18, N. Y.

POWER SUPERVISOR or Assistant Chief Engineer: Twelve years experience with large industrial plants covering all inside and outside power operations and maintenance. 37 years of age, married. Industrious and capable. No bad habits. Highest recommendations. Locate permanently. Salary $325.00 minimum. PW-269, Power, 520 N. Michigan Ave., Chicago 11, Ill.

CHIEF ENGINEER—Centrifugal pumps. Familiar all engineering, manufacturing and business phases. Modern, efficient, standardized or special design. All types. Industrial, Navy, Ejector. Existing lines modernized. Successful executive many years. Will consider opportunities in other fields. PW-271, Power, 330 W. 42nd St., New York 18, N. Y.

LICENSED STEAM Engineer: Desires responsible position with Industrial or Municipal Power Plant, offering chance for advancement. Eight years experience in plant operation. Ohio Second Class Steam Engineer's license. Married, with small family. 26 years of age, excellent health. Reason for desired change is that present position holds no future for advancement. Definitely not a boomer or drinker. Best references. I.C.S. student, Navy veteran. PW-272, Power, 330 W. 42nd St., New York 18, N. Y.

STRUCTURAL ENGINEER, Designer, Draftsman, age 50. 20 years heavy power plant experience, 15 years responsible charge. High aptitude for preliminary and design sketching. Experienced field surveys, heat balance, testing. Present salary $5400. Res. Philadelphia. PW-273, Power, 330 W. 42nd St., New York 18, N. Y.

Additional Employment Ads on page 296

MECHANICAL
ELECTRICAL
STRUCTURAL
ARCHITECTURAL
DESIGNERS & DRAFTSMEN

The Austin Company solicits applications from men interested in the opportunities offered by a nation-wide organization prominent in the industrial building field.

Positions are open in New York, Cleveland, Chicago and Oakland

Mechanical—Heating, air conditioning, ventilation systems, process piping, conveying systems, plumbing, sewer and sprinkler systems.

Structural—Industrial buildings and miscellaneous structures of steel and reinforced concrete.

Electrical—Industrial lighting and power distribution.

Applications should be made to one of the following offices and should give full particulars and compensation desired in first letter.

THE AUSTIN COMPANY

New York City
19 Rector St.
Whitehall 4-6393

Chicago, Illinois
510 No. Dearborn
Superior 6100

Oakland, Calif.
618 Grand Ave.
Highgate 6070

National Headquarters
16112 Euclid Avenue
Cleveland, 12, Ohio
Glenville 5400

WANTED

Sales Representatives

A few good territories are available for ambitious men to sell boiler water treatment, fuel oil treatment, soot remover, etc. Our established line includes other excellent industrial products. Our representatives know of this advertisement. Reply stating experience and qualifications.

RW-253, Power
330 West 42nd St., New York 18, N. Y.

CASH PAID

For Capital Stock or Assets of
INDUSTRIAL ENTERPRISE

• WANTED

By large financially powerful diversified organization wishing to add another enterprise to present holdings.

Existing Personnel Normally Retained
STRICTLY CONFIDENTIAL
Box 1234, 1474 B'way
New York 18, N. Y.

WANTED

(Additional Wanted Ads on Page 328)

WANTED

SALES REPRESENTATIVE

on commission basis to represent a nationally established manufacturer of automatic combustion control in the Chicago territory. Representative must have contacts with consulting engrs. and large industrial plants.

RW-258, Power
330 West 42nd St., New York 18, N. Y.

FOR SALE

Skinner Steam Engine

size 17 x 20.

Left hand variable speed Universal Uniflow heavy duty. 230 HP at 225 RPM. New in 1938, excellent condition. Available due to plant liquidation. May be inspected in Chicago.

WM. W. MEYER & SONS CO.
5032 Elm Street, Skokie, Illinois
Phone: Ambassador 2727

WANTED TO PURCHASE

Up to 4 units, 125 kilowatts each, 80% power factor, 3 phase, 60 cycle, 220 volt. Would like them complete with switchboard, piping and auxiliary equipment. Must be in first-class condition and obtainable at a moderate price. Would prefer 4 units but could use 3—200 KW units. Advertiser is consulting engineer for principals who desire to purchase the equipment. Send full particulars to

W-260, Power
330 West 42nd St., New York 18, N. Y.

Manufacturers representatives established now handling Boiler Plant Maintenance Items desires additional lines in Philadelphia metropolitan area.

TRI-STATE SUPPLY CO.
33 South Front St. Phila. 6, Pa.

WANTED

GENERATING SETS

Several 18" or 20"x36" Corlis engine generating sets, heavy duty engines, DC or AC.

JAMES K. HOOPER
50 Church St., N. Y. C. 7

FOR SALE

TWO SKINNER ENGINES,

good running condition, one center crank and one side crank equipped with automatic governor, 14" bore and 14" stroke, 280 RPM. The center crank machine is equipped with 110 Volts, D.C., 75 KW, 600 AMPS, Westinghouse generator.

OLD POINDEXTER DISTILLERY
1412 Heyburn Building Louisville, Kentucky

---

200 HP MOTOR

550 V, 3PH, 60 CY WEST.

900 RPM, Type CS Induction, Frame 874D, with Standard Base. Practically new—used under four months.

THE GORDON L. HALL CO.
Old Lyme, Conn.

WANTED

HYDRO TURBINE GENERATOR

VERTICAL SETS
550 or 2200 volts 3P. 60C.

ANDREW S. FORMAN CO.
1425 Dorchester St. W., Montreal, Canada

THIS JLHCo

K on the equipment you buy means

used equipment-rebuilt and tested by our electrical engineers — to N. I. S. A. standards

MOTOR GENERATOR SETS

1—300 KW General Electric, type MPC, 125/250 volt 1200 RPM, direct connected to 1—500 H.P. Ideal 1200 RPM. synchronous 4150 volt, 3 phase, 60 cycle, with direct connected exciter and control.
1—125 K. W. Crocker-Wheeler 125 V. Sq. Cg. 2300 V. 3 phase, 1200 RPM.
1—100 K.W. Electric Machinery, 125 volt, synchronous motor, 4150 volt, 3 phase, 1200 RPM.
1—100 K.W. General Electric, 230 volt, squirrel cage, 440 volt 3 phase 1200 RPM.
6—17 K.W. Allis-Chalmers 3 unit 125 V. Sq. Cg. 220 V. 1800 RPM.

ENGINE GENERATOR SETS

1—150 KVA. G.E. Ames Unaflow Engine, non-condensing.

TURBO GENERATORS

1—600 K.W. Terry dual bleeder condensing Turbine only.
1—300 K.W. General Electric, 3 phase, 60 cycle, 220 volt cond.
1— 30 K.W. 125 volt Allis-Chalmers non-cond.

TRANSFORMERS

2—500 KVA. single phase, Allis Chalmers 7800/13,800 primary, 115/230 secondary.
3—150 KVA. 3 phase, General Electric, type HT. 27,060 primary, 125/216Y secondary.
1—1000 KVA. Auto Transf. 4150 V. 3 Ph. 4 wire to 2406 V. 2 Ph.
3—100 KVA. Westinghouse 11430/250 volt.
2—100 KVA. General Electric 13200/250 volt.
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v.
2— 50 KVA. Pittsburgh 4000 volt, 110/220.
20—Brand new General Electric air-cooled 440/220 volt primary, 220/110 secondary.
20—Brand new ditto only 220 volt primary, 220/110 secondary.
1— 15 KVA. Pittsburgh 4000 volt, 110/220 secondary.

ALTERNATORS

1—500 K.W. 3600 RPM. 600 volt, General Electric D.C. exciter.
1—200 KVA. 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter.
1—180 K.W. 514 RPM. 550 volt, Westinghouse.
1—165 K.W. 514 RPM. 2400 volt, Electric Mach.
112 KVA. type TS, General Electric, 900 RPM. 220 volt.
1—20 K.W. General Electric, ATB, 720 RPM., 2200 volt, 3 phase, 60 cycle.
1—62½ K.W. 3600 RPM. 230 volt, Allis-Chalmers.
1—40 K.W. 1800 RPM. 550 volt, General Electric.
1—35 K.W. 1200 RPM. 240 volt, Columbia Electric D.C. exciter.
1—31.3 KVA. 1200 RPM. 120/280 volt, American D.C. exciter.
1—12.5 KVA. 1200 RPM. 240 volt, Westinghouse, D.C. exciter.

MOTORS—VARIABLE SPEED

230 VOLT

2—200 H.P. 425/212 RPM, General Electric MPC.
1— 40 H.P. 755/1000 RPM, Sprague LC.
1— 30 H.P. 400-120 RPM, General Electric RC-204.
1— 25 H.P. 650/2200 RPM. Westinghouse SK1110L.
1— 25 H.P. 500/1500 RPM. General Electric RF-12.
1— 25 H.P. 400/1200 RPM. Westinghouse SK.
2— 25 H.P. 300/900 RPM. Electro Dynamic.
1— 15 H.P. 300/1200 RPM. General Electric RLC-2024
1—13/18 H.P. 350/1200 RPM Electro Dynamic.
3—11½ H.P. 500/1500 RPM. Westinghouse.
1—7½/10 H.P. 500/1500 RPM. Reliance.
1—6/7.5 H.P. 450/1800 RPM. Croker Wheeler CMC.
1—5 H.P. 500/1500 RPM. Reliance.
1—5 H.P. 600/1200 RPM. General Electric LC.
1—5 H.P. 450/1800 RPM. Crocker-Wheeler CM.
1—5 H.P. 400/1600 RPM. Diehl K6.
1—5 H.P. 225/900 RPM. Electro-Dynamic.

MOTORS 3 PHASE 60 CYCLE

SLIP RING

1—500 H.P. 900 RPM. Lincoln 440 volt.
1—225 H.P. 1800 RPM. General Electric 1-L 220 volt.
1— 75 H.P. 900 RPM. General Electric ITC 220 volt.
1— 40 H.P. 1150 RPM. Cont. Electric SA85 220 volt.
1— 40 H.P. 1130 RPM. General Electric Mt. 2200 volt.

MOTORS 3 PHASE 60 CYCLE

SQUIRREL CAGE

2—450 H.P. 900 RPM. Ridgway, 2200 volt, 3 phase, 60 cycle.
1— 75 H.P. 720 RPM. Crocker Wheeler 550 volt.
2— 50 H.P. 900 RPM. Fairbanks-Morse H. 220 volt.

D. C. GENERATORS

1—300 K.W. 250 V. G.E. MPC 1000 RPM.
1— 75 K.W. 250 V., Westinghouse 260 FPM.
1— 50 K.W. 115 V. Westinghouse 1200 RPM.
2—31.2 K.W. 125 V. Westinghouse 1400 RPM.
2—20 K.W. 50 V. G.E. 1800 RPM.

MOTORS D. C.

230 VOLT

2—450 H.P. General Electric MPL 250 volt, 400 RPM.
1—250 H.P. 750 RPM. Electro Dynamic 230 volt.
1—125 H.P. 1725 RPM. General Electric RC-230 volt.
1— 75 H.P. 575 RPM. General Electric C230 volt.
2— 50 H.P. 700 RPM. Crocker-Wheeler CM 230 volt.
1— 30 H.P. 1100 RPM General Electric RC-12 230 volt.
1— 30 H.P. 625 RPM. General Electric C 230 volt.
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt.
1— 20 H.P. 800 RPM. General Electric RC 12 230 volt.
1— 15 H.P. 350 RPM. Diehl G-312 230 volt.

SYNCHRONOUS MOTORS

1—75 H.P. 180 RPM. Electric Machinery, 2200 V. 3 phase, 60 cycle.
1—500 KVA. G.E. 900 RPM. ATI 4150 V. D.C. exciter.
2—160 H.P. Elec.Mach. 1800 RPM.. 220 V.D.C. exciter.
1—100 H.P. G.E. type TS, 600 RPM. 440 volt D.C. Exciter.
1— 75 H.P. 1200 RPM. ATI 220 V. 3 phase.
1— 50 H.P. G.E. 1800 RPM. TS 220 V.
1— 50 H.P. G.E. 1800 RPM. ATI 220 V. D.C. exciter.
1— 35 KVA. G.E. 1200 RPM. ATI 2200 V. D.C. exciter.
1— 20 H.P. Westinghouse 1800 RPM. 220 V. .8 P.F.

FREQUENCY CHANGERS

1—7½ K.W. 15 KVA. 50% P.F. 1800 RPM. 215 V. 270 Cy. C.W. Westinghouse.
2—15 K.W. G.E. Type MM. 270 cy.

VERTICAL MOTORS

1—75 G.E. Vert. Solid Shaft 1200 RPM. 220 S.R.
1—60 Westinghouse Solid Shaft 900 RPM. 2200 S.R.

MISCELLANEOUS

2—2100 Gallon Pumps Dayton-Dowd 100 foot head.

JLHCo

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

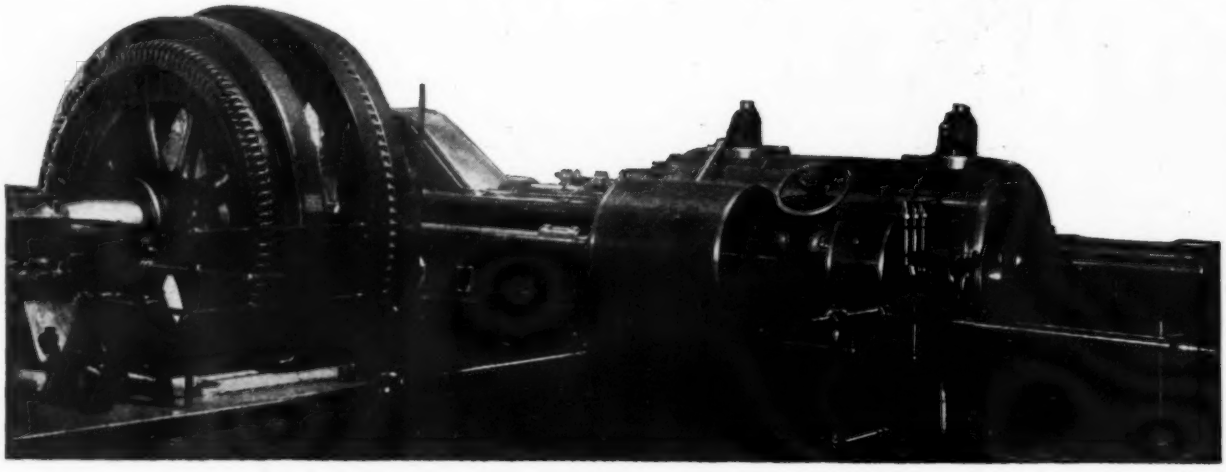
J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY



750 KVA NORDBERG UNIFLOW ENGINE GENERATOR UNIT

600 KW 80% P.F. 750 KVA General Electric alternating current generator 3 phase 60 cycle 4000/2300/600/480/240 volts 150 RPM direct connected to Nordberg uniflow noncondensing engine, 150-200# steam pressure 0-15# back pressure. This unit is in excellent condition, available for immediate delivery.

UNIFLOW ENGINE GENERATOR UNITS

3 phase 60 cycle

750 KVA Skinner, 2300 volts, 175# pressure, 15# exhaust
560 KVA Skinner, 480 volts, 150# pressure, 20# exhaust
375 KVA Skinner, 2300 volts, 150# pressure, 5# exhaust
375 KVA Skinner, 480 volts, 150# pressure, 10# exhaust
375 KVA Skinner (vert, 240 volts, 150# pressure, 5# exhaust
250 KVA (2) Ames (vert), 240 volts, 160# pressure, 2# exhaust
210 KVA Skinner, 240 volts, 150# pressure, 5# exhaust
150 KVA Ames, 240 volts, 150# pressure, 3# exhaust

ROTARY CONVERTERS

3 phase 60 cycle

1000 KW (3) General Electric type HCC, 600 volts D.C., 33,000 volts A.C.

MERCURY ARC RECTIFIERS

1000 KW American Brown Boveri, 600 volts D.C.; 4000 volts A. C.
900 KW American Brown Boveri, 600 volts D.C.; 2300 volts A.C.
750 KW General Electric, 600 volts D.C., 2300 volts A.C.
500 KW General Electric, 600 volts D.C.; 2300 volts A.C.

STEAM TURBINE GENERATOR UNITS

Condensing

3 phase 60 cycle

12500 KVA G. E. 11000 V. 275#
5000 KVA G.E. 2300 V. 200#
3750 KVA Wstgh. 4160 V. 200#
3125 KVA Wstgh. 2300 V. 200#
2500 KVA G.E. 2300 V. 200#
2500 KVA G. E. 600 V. 150#
1875 KVA Allis 480 V. 175#
1563 KVA G.E. 2300 V. 125#
1563 KVA G.E. 600 V. 175#
1250 KVA Wstgh. 2300 V. 150#
1250 KVA (2) G.E. 480 V. 150#
1250 KVA G.E. 2300 V. 175#
937 KVA G.E. 2300 V. 150#
750 KVA G.E. 2300 V. 210#
625 KVA G.E. 2300 V. 200#

STEAM TURBINE GENERATOR UNITS

Automatic Extraction

3 phase 60 cycle

3750 KVA (2) G.E. 2300 volts, 200# pressure, 20# extraction
3750 KVA Wstgh. 2300 volts, 150# pressure, 10# extraction
1250 KVA Allis 480 volts, 250# pressure, 25# extraction
937 KVA Westinghouse, 480 volts, 150# pressure, 10# extraction
625 KVA Westinghouse, 480 volts, 250# pressure, 25# extraction

DIESEL ENGINE GENERATOR UNITS

3 phase 60 cycle

1250 KVA (2) Fairbanks Morse, 2300 volts, 720 RPM
1250 KVA (2) Fairbanks Morse, 480 volts, 720 RPM
1000 KVA General Motors, 2300 volts, 720 RPM
625 KVA Fulton, 440 volts, 164 RPM
500 KVA (2) McIntosh-Seymour, 2300 volts, 164 RPM
375 KVA (4) Chic. Pneum., 2300 volts, 257 RPM
250 KVA Fairbanks Morse, 2300 volts, 257 RPM
250 KVA Buckeye, 240 volts, 400 RPM
125 KVA Buckeye, 240 volts, 400 RPM

STEAM TURBINE GENERATOR UNITS

Noncondensing

3 phase 60 cycle

1250 KVA G.E., 2300 volts, 150# pressure, 20# exhaust
937 KVA Moore, 2300 volts, 175# pressure, 20# exhaust
625 KVA G.E., 2300 volts, 200# pressure, 10# exhaust
375 KVA G.E., 480 volts, 150# pressure, 20# exhaust
250 KVA Wstgh. 600 volts, 150# pressure, 15# exhaust
250 KVA Wstgh., 480 volts, 300# pressure, 30# exhaust
187 KVA G.E., 250# pressure, 15# exhaust

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

Now its 39 YEARS OF BELYEA SERVICE

Supplying "SUCCESSFUL OPERATION GUARANTEED"

RE-NU-BILT EQUIPMENT

RE-NU-BILT BELYEA MOTORS

D.C. MOTORS

	HP	Make	Type	Volts	Speed
2—	800/1000	Whse.		450	600/720
1—	800	G.E.	MPC	660	600
1—	700	G.E.	MCF	600	150/525
1—	650	G.E.	MPC	250	115/145
1—	600	G.E.	MPC	600	650/900
2—	350	G.E.	MPC	220	450
1—	335	Whse.	MQ	250	300/900
1—	325	Whse.		230	1050/1250
1—	300	G.E.	DMC	230	400/600
1—	300	G.E.	MPC	230	275/650
2—	300	Cr. Wh.	CCM-151-H	230	630/700
1—	250	G.E.	MPC	230	400/500
1—	250	Al. Ch.		230	525
1—	150	G.E.	MPC	230	250/450
1—	130	Cr. Wh.	CMC-65H	550	1200
2—	125	G.E.	CO	230	625
1—	100	G.E.	MPC	230	225/450
1—	75	Whse.	SK-180	125	650
1—	75	G.E.	C	230	500/1000
1—	75	G.E.	C	230	650/900
1—	60	El. Dy.	25-S	230	525/1050
2—	60	Whse.	Hoist	230	415
4—	50	Whse.	Hoist	230	400
2—	50	Cr. Wh.	65H	230	500/1000
6—	50-½ hr.	G.E.	MD-105B	230	550
1—	50	G.E.	RC-16	230	650
4—	50	Whse.	SK-160	230	565
1—	50	El. Dy.	50S	500	194/775
1—	50	Cr. Wh.	CMC-80H	230	380/750
1—	50	Cr. Wh.	CMC-81-H	230	300/900
1—	40	Whse.	SK-120	230	1700

TURBO GENERATOR SETS

4—500 KW Whse. 625 KVA 440 V., 3 ph. 60 cy. 3600 RPM with Parsons' 145/175 lb. condensing turbine complete with jet condenser, and accessories.
1—300 KW Whse. D.C. 120/240 V., 1200 RPM., driven through reduction gear by turbine 5965 RPM., 440 lb. 740° T.T. Condensing.
1—125 KVA GE 2300 V. 3 ph. 60 cy. 3000 RPM. 150/200 lbs. Non-condensing.
1—100 KVA, GE 2400 V. 3 ph. 60 cy. 3600 RPM. 150/200 lbs. Non-condensing.
1—75 KW Ridgway 250 V. D.C. with Terry 180 lb. pressure with 12 lbs. back pressure, 2000 RPM.

SPECIAL

1—2500 Kva. GE. Auto-extraction, 3600 RPM. 150/175 lbs., Surface Condenser & Accessories; 3 ph., 60 cy., 480 v., direct connected exciter. Immediate Shipment.

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1000 KW Al. Ch. 450 V. d.c. to 1250 KVA 2300 V.
2—500 KW Whse. 120/240 V. d.c. to 700 HP. 440 V. Syn. Motor.
1—500 KW GE-600 V. d.c. to 700 HP-2300 V.
1—375 KW Whse. 125 V. d.c. to 600 HP. 2300/4000 V. Syn.
1—400 KW 3 unit with (2) 200 KW GE 125 V. D.C. gens. and 600 HP. 2300 V. Syn. Motor.
1—300 KW GE 550 V. d.c. to 435 HP. 2300/4000 V. with exciter.
1—300 KW Al. Ch. 120/240 V. d.c. to 500 HP. 440 V. Syn.
1—250 KW GE-275 V. d.c. to 350 KVA, 2300 V. with exciter.
1—250 KW Al. Ch. 250 V. d.c. to 340 KVA 2200 V.
1—200 KW GE 250 V. d.c. to 300 HP. 440 V.
1—150 KW Whse. 250 V. d.c. to 270 KVA 440 V. with exciter.
1—150 KW Whse. 600 V. d.c. to 225 HP. 2300 V.
1—85 KW GE 250 V. DC to 150 HP. 440 V. Sq. Cg. Motor.
1—75 KW GE 125 V. Gen. to 120 HP. IK 4000/2300.
2—48 KW 3 unit with 2—24 KW GE 60 V. Gens. d.c. to 75 HP. 440 V. Ind. Motor.
1—26.4 KW W.E. 38 V. Gen. d.c. to 41.5 HP. 220 V.
1—19.8 KW W.E. 33 V. Gen. d.c. to 32 HP. 220 V.

ROTARY CONVERTERS

60 cycle

	KW	Make	Speed	D.C. Volt	Trans Volts
1—	1500	Whse.	720	600	2300
1—	1000	Whse.	900	600	11000
1—	750	Whse.	900	600	13200
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300

All units can be furnished with AC and DC Controls.

SPECIAL
TURBO ALTERNATERS

1—2500 KW Whse. 3600 RPM. 2400/4160 V. 3 ph. 60 cy. Recently rewound.
1—2000 KW Whse. 3600 RPM. 480 V. 3 ph. 60 cy. dir. conn. exciter.
1—750 KW Whse. 3600 RPM. 480 V. 3 ph. 60 cy. dir. conn. exciter.
1—500 KW Whse. 3600 RPM 480 V. 3 ph. 60 cy.

A.C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
2—	2100	G.E.	ATI	2300/4600	514
2—	350	G.E.	TS	2200	150
1—	300	Whse.		600	600

Slip Ring

1—	2500	G.E.	MT	6600	253
1—	1000	Whse.	CW	2300	705
1—	350	G.E.	MT-442y	4000/2300	257
1—	300	Whse.	CW	440	1800
1—	250	Al. Ch.	ANY	440	705
1—	250	G.E.	MT-424y	4000	253
1—	225	G.E.	IM	550	720
2—	200	Whse.	CW-1000	440	580
1—	.90	Wagner	BR-26V4	220/440	650
1—	.75	F.M.	BY	2200	1750
3—	50	Whse.	CI	220	870

Squirrel Cage

1—	250	G.E.	IK	440	600
1—	200	G.E.	IK	2200	1175
1—	200	Al. Ch.		2200	1175
1—	200	G.E.	IK	440	900
2—	150/70	G.E.	IK	440	1170/870
1—	100	G.E.	IK-vert.	2300	450
2—	100	G.E.	IK	440	865

D.C. GENERATORS

	KW	Make	Type	Volts	Speed
1—	1200	Al. Ch.	MHC	525	750
1—	500	G.E.	MPC	600	720
1—	200	Al. Ch.		250	580
2—	200	G.E.	CY-214	250/275	900
1—	150	G.E.	MPC	125	200
1—	150	Whse.	5K-151B	275	1200
2—	100	Whse.		240	250

SPECIAL

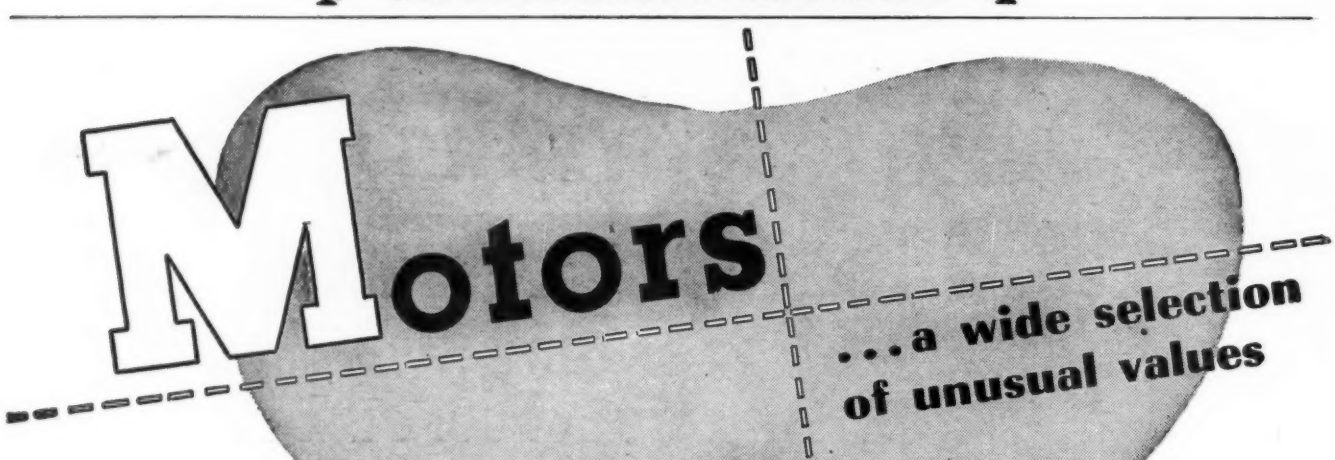
1—2000 amp. 3 PST 15000 V. 250 V. Sal Operated Condit type F-120-15D OCB 1,000,000 Kva interrupting Capacity.

We Buy for Stock — for CASH
What Surplus Do You Have?
PHONE — JOURNAL SQUARE — 2-3334
Also
N. Y. CITY LINE — RECTOR 2-7150

WE OWN BELYEA COMPANY, INC.

WHAT WE ADVERTISE—*SO IT'S GOOD!*

MAIN OFFICE AND SHOP
43 HOWELL ST., JERSEY CITY 6, N. J.



Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 220/440 Volt.

Qu.	HP	Make	Type	Speed
1	300	G.E. 440v.	ATI 1800 RPM Syn.	
1	250	G.E. 440v.	KF 3600 RPM Vert.	
1	150	Al. Ch.		1750
2—Cr. Wh.—Size 126Q—125 HP—430 RPM				
1—G.E.—150 HP—I—550 V—380RPM				
1—West.—100 HP—CS—870 RPM				
1	100	West. 2200v.	CCL	1720
1	100	G.E.	I	340
1	100	G.E.	I	290
1	100	G.E. 440v.	PCS	375 RPM
1—G.E.—75 HP—I—575 RPM				
1—G.E.—50 HP—I-K—900 RPM—2200 V				
1	50	G.E.	I	720
2	50	West.	MS 25 cy.	720
1	50	Wag.	BM	495
1	50	Al. Ch.		490
1	40	West. 2200v.	CS	870 RPM
1—G.E.—40 HP—KT542—720 RPM				
2	35	Al. Ch.	2 hp.	865
2	35	Al. Ch.		865
1	35	Ft. Wayne	2 ph.	900
1	35	G.E.	25 cy.	730
1—Cr. Wh.—30 HP—860 RPM				
1—Al. Ch.—30 HP—690 RPM—2200 V				
1	30	F.M. 2200v.	HD12B	3600
1	30	Al. Ch.		1200
1	20	Louis A.	KH	1170
1	30	West.	CCL	900
2	30	Al. Ch.	An 2 ph.	860
1	30	Century	AS 25 cy.	720
1	25	Howell		1200
1	25	Lincoln		900
1	25	Al. Ch.		860
1	25	Al. Ch.		720
1	25	G.E.	M10	720
1—Burke—25 HP—EM—900 RPM				
1	20	F. M.	KRV	1200
1	20	Clev.	M-147	900
1	20	Al. Ch.		860
3—U. S. 20 HP—SC—1800 RPM, splash proof, ball bearing				
1—West.—20 HP—CS—1750 RPM				
1—G.E.—20 HP—I—900 RPM—2200 v				
2	20	(New West 220/440v. CS404, 1200 RPM		
1	18	West.	MS-4 (Elev.)	720
1	15	West.	CCL	1700
1—G.E.—15 HP—KT—1750 RPM				
1—Star—5 HP—SB3—1200 RPM, totally enclosed, ball bearing				
1—G.E.7—½ HP—KT—1800 RPM				
2	15	West.	CS-573 25 cy.	725
2	15	West.	MS 25 cy.	725
1	15	West.	CS567C 25 cy.	715
1	15	West.	MS 25 cy.	600
1	10	West.	CS 25 cy.	725
1	10	West.	MS 25 cy.	720
2	10	West.	CS473C 25 cy.	615
1	7½	Wagner	MCP-365 TEFC	1140

SLIP RING

3 Phase, 60 Cycle, & Syn.

Qu.	HP	Make	Type	Speed
1	443	El. Mach.		900 Syn
1	200	F.M.	BV	600
2—G.E.—150 HP—MT562S—720 RPM				
2	75	F.M. 2200v.	BV-H16B	1800
1	50	Triumph	C12	1150
1	50	Ideal 2200v.	AV	575
1	50	G.E.	IM 25 cy.	700
1	50	Al. Ch.		690
1	50	West. 220v.	CW752	690 RPM
1—West.—50 HP—CW752C—900 RPM				
2	40	G.E.	MT336	1200
1	40	Al. Ch.		1160
1	40	W'g 2200v.	CW	870
1	40	Westg.	CW-658-A	870
2	40	Al. Ch.		870
1	40	Westg.	C1753A 25 cy. cr.	730
10	35/15	G.E.	OMT336 (hoist)	1150/550
1	35	Al. Ch.	25 cy.	720
2	35	G.E.	IM	570
1	30	F.M.	AD Alt.	1200
1	22	G.E.	TTC5011 (hoist)	680
1—Cr. Wh.—25 HP—CW—690 RPM				
1—Cr. Wh.—25 HP—1155 RPM				
1	25	Westg.	MW322A	680
1	25	G.E.	MT342	600
1	25	G.E.	MT356	400
1	20	Triumph	C10	1200
2	15	G.E.	MT302	1200
1	15	G.E.	MT332	720
1—G.E.—15 HP—MT512—900 RPM				
1	15	G.E.	MT556	280
3	10	Westg.	CW464A	1200
1	10	Westg.	HF	1140
1	7½	G.E.	MT182	1750
6	2	G.E.	MT926 slip ring	1800

DC—230 Volt

Qu.	HP	Make	Type	Speed
1	75	Diehl	K11	550
1	100	G.E.	CD123	1200
1	60	Westg. 115v.	SK140L Vert.	1140
1	60	G.E.	EFI	1200
1	40	Rel. 440v.	13LT Vert.	1750
1	40	Rel. 440v.	230T Vert.	1130
1	25/40	C.W. 440v.	CMC-EH Vert.	1150/1750
1	40	Westg.	SK 123	1150
3	40	G.E.	RC32	1100
8	40	Westg.	SK 140	775
1	35	Al. Ch.		1200
1	35	G.E.	DLC 203	700
1	30	EL. Dy.	158	625
1	30	Rel. 440v.	131 T Vert.	1150
4	30	Reliance	92 TF	1750
1	27½	G.E.	CVC 116	1750
7	25	Westg.	SK 120	825
2	25	Westg.	SK 103	1150
1	25	Westg.	SK 90	1400
4	25	Westg.	SK 100 L	1150
1	30	G.E.	RC 51B	1150
1	25	Westg.	SK 123	550/1100
1	25	Al. Ch.	E 120	500/1500
1	25	J. & L.		625
2	20	Reliance	131T	1000
2	20	Diehl	K914-A	500/1500
1	20	G.E.	RF12	250/1000
1	20	Lincoln	FKW B.B.	1800
6	20	Cr. Wh.	CMC T.E.B.B.	1750
1	20	Cr. Wh.	CMC T.E.B.B.	1150
1	20	Westg.	SK93	1150
14	20	Reliance	92T	1150
1	20	Westg.	SK 120 T.E.	1100
3	20	Westg.	SK 100L	900
1	20	Watson	K	850
3	20	Reliance	131T	850
1	20	G.E.	RC30	750
1	20	Westg.	SK110L-115V	750

DC—230 Volt

Qu.	HP	Make	Type	Speed
4	20	Westg.	SK110L	750
1	20	Cr. Wh.	CW-CMC	600
1	20	Westg.	SK-120	500
3	20	Al. Ch.	K	500/100
2	15	Westg.	SK63	1750
1	15	Westg.	SK113 encl.	1750
1	15	Westg.	SK93	1150
4	15	Westg.	SK83	1150
4	15	Cr. Wh.	CW-CCM T.E.	1150
1	15	Westg.	SK70L	1250
1	15	G.E.	CD83	1150
1	15	G.E.	RC10	1150
1	15	G.E.	RC29	1150
4	15	Westg.	SK93	850
4	15	Reliance	92TF	850
4	15	R. & M.		1000
1	15	G.E.	CVC-115	925
6	15	Westg.	SK90 Vert.	825
1	15	G.E.	RC29	750
6	15	Westg.	SK110L	675
1	15	Al. Ch.		1075
8	15	Reliance	131T	550
3	15	Reliance	92T	850/1750
3	15	Reliance	92T	850/1700
1	15	Reliance	66T	800/1600
1	15	Westg.	SK	500/1500
2	15	Westg.	SK110L	400/1600
1	15	Triumph	32F	300/600
1	15	Triumph		225/900
1	12½	Westg.	SK	750/1500
7	10	Westg.	SK70	850
2	10	G.E.	RC29	850
2	10	Reliance	66TF	850
20	10	Westg.	SK60L-SK60-Reliance 46TF	1150
7	10	Cr. Wh.	CM CHB T.E.B.B.	1750
1	10	G.E.	RF11	600/2400
3	10	G.E.	RF10	600/1800
6	10	Westg.	SK80L	500/1500

DC—230 Volt

Qu.	H.P.	Make	Type	R.P.M.
23	10	Al. Ch.		500/1000
1	10	G.E.	RF10	540/1200
2	10	Kimble	BA324 new B.B.	1750
1	10	Westg.	SK91	250/1000
15	7½	Westg.	SK33	1750
16	7½	Westg.	SK43	1150
20	7½	Westg.	SK60	850
20	5	Westg. & G.E.		1750
20	5	Westg. Rel.		1150
35	5	Westg.	SK43	580
50	3½	Westg.	SK33	850
50	3	Westg.	CD925	1725
70	3	Westg.	SK20	1550
60	2	Westg.	SK & CD	1150
50	2	Westg.	SK20	850
40	1½	Westg.	CD	1150
30	1½	Westg.	CD925	550/2200

41 New vertical TEFC BB 3 phase, 220/440 volt, 60 cycle, as follows:
1—G. E. 2 HP—1200 RPM—ty. K. frame 225
1—Fairbanks Morse 3 HP. 1200 RPM, Type QZCU, Frame 254
2—Delco 3 HP 1200 RPM, Type C Frame 254
3—G. E. 3 HP—1200 RPM—ty. K, frame 254
1—General Electric, 5 HP, 1800 RPM, Type K Frame 254
8—General Electric, 7½ HP, 1200 RPM, Type K Frame 324
7—Delco, 7½ HP, 1200 RPM, Type C Frame 324
1—Howell, 7½ HP, 1200 RPM, Type K, Frame 324
2—Howell, 7½ HP, 1800 RPM, Type KV Frame 284
2—Delco 10 HP, 1200 RPM, Type C Frame 326
1—Delco 15 HP, 1200 RPM, Type CL Frame 365
6—G. E. 15 HP—1200 RPM—ty. K, Frame 365
2—Howell, 15 HP 1200 RPM, Type KV, Frame 365
2—Delco, 20 HP, 1200 RPM, Type CL, Frame 404
2—Howell, 20 HP, 1200 RPM, Type K Frame 404

6—New General Electric Synchronous Motors Type T.S. 200 H.P. 300 RPM, 2200 volt .8 p.f. Complete with control & separate motor generator exciter set.
1—150 KW Westinghouse, synchronous M-G set, 275 Volt DC, 4400 Volt AC, 3 ph., 60 cycle, 900 RPM, AC control and DC panel
1—150 KW General Electric, M-G set, 250/275 Volt, DC—440 Volt AC—3 phase, 60 cycle, 900 RPM.
2—Ridgeway 100 KW. Synchronous M-G sets, 250 volt DC, 2300 volt AC. 3 ph., 60 cycle, 1200 RPM, AC controls and DC panel.
1—Burke 200 KW, synchronous M-G sets, 260 volts DC, 440 volts AC, 3 ph., 60 cycle, 900 RPM, with AC and DC controls.

1—New G. E. 250 HP, ty. KF, fr. K 549A., 440 V., 3 Ph., 60 Cy., 3600 RPM vert. direct connected to Bingham, type 2, 22 stage double case, 3600 RPM, 3820 head, 175 GPM pump.

The Wente Electric Co.

Hamilton, Ohio

Rebuilt Motors & Generators
Since 1906

D. C. MOTORS AND GENERATORS

1 YEAR GUARANTEE

125 V. - 250 V. - 550 V. D.C. GENERATORS (Motor Driven and Belted)

KW	Make	Voltage	Ampere	Speed
500	G.E.	600	833	720
300	Al. Ch.	250/125	1200	1200
250	G.E.	125	2000	690
200	West.	250	800	900
200	Cr. Wh.	550	363	900
150	Al. Ch. (2)	250	638	1200
150	G.E.	250	600	580
150	Ideal	250	600	900
150	G.E.	125	1200	1200
100	G.E.	250	400	900
100	G.E.	125	800	1150
100	Delco (2)	250/125	400	1150
75	Cr. Wh.	125	600	1150
60	West.	125	480	1800
60	G.E.	125	480	900
40	G.E. (8)	250	160	1150
40	Century	125	320	1450
40	West.	250/125	160	1500
40	G.E.	250	160	800
25	Allen	110	320	500
30	G.E. (3)	250	120	1750
20	Delco	125	160	1200
20	West. (6)	125	120	1200
20	Col. (3)	125	160	1750
20	G.E.	125	160	400
15	West.	125	120	1750
15	Roth	125	120	900
15	West.	230	60	1450
15	G.E.	125	120	1150
15	Scott	110	136	500
15	G.E. (3)	125	120	850
12½	F.M.	125	100	1450
10	Rogers (2)	125	80	1450
10	El. Dy.	125	80	600
8	G.E. (2)	125	64	1800
7½	G.E.	125	60	1800
5	G.E. (2)	125	40	1740
5	Rel.	250	20	1725

80—Additional generators—125 V. up to 200 V. generators in stock.

LOW VOLTAGE D.C. GENERATORS

KW	Make	Voltage	Ampere	Speed
1-6/1:	Hertner	80	20	1800
75	G.E.	75	1000	1145
22½	West.	75	300	720
24	G.E.	60	400	1800
1-1/8	G.E.	60	1	1800
3	Hertner	60	60	1730
40	G.E. (6)	50	800	1160
3/4	H.C.	46	11½	1750
8½	G.E.	42	205	1800
5	Diehl	40	125	1750
33	G.E.	33	1000	850
6½	G.E.	32	205	1800
2½	Witte	32	75	1800
3	G.E.	30	100	1200
48	West.	30	1600	600
6	Star (2)	25	250	1800
5	Star	25	200	1750
15	Rel.	24	625	1450
4	Star	20	200	1800
1	G.E.	20	15	1800
106	El. Pr.	18	6000	
		36	3000	600
1	West.	16	60	1750
22½	Star	15	1500	1200
15	G.E.	15	1000	1200
11	Star	15	750	1200
1	Cont. (2)	15	67	1750
4½	Star	15	300	1800
30	Columbia	8-16	5000/2500	720
12	H.V.W.	12/24	1000/500	900
7½	Eddy	5/10	1500/750	860

300—Additional low voltage generators in stock.

D.C. MOTOR DRIVEN A.C. GENERATORS

31 KVA Ideal 3 phase output driven by 40 H.P. 115 V. D.C. motor.

25 KW Electric Machinery 3 phase output driven by 40 H.P. 230 V. D.C. motor.

7½ KVA Star single phase output driven by 125 volt D.C. motor.

5 KVA Electric Specialty single phase output driven by 115 V. D.C. motor.

2¼ KW Diehl single phase output driven by 110 volt D.C. motor.

1—KW Allis-Chalmers single phase output driven by 110 V. D.C. motor.

150—Additional units in stock including small size rotary convertors.

230 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	600	G.E.	600 v.	600/900
1	125	West.	SK	825
1	100	West.	SK-180	625
1	100	Rel.		475/635
1	75	West.	SK	475
1	75	Cr. Wh.	New	480/670
3	60	West.	SK-160	680
1	60	G.E.	C	480/1100
1	50	West.	CK-9	525
1	50	G.E.	RC-19	400/1200
1	45	Diehl	K-10	850
2	40	G.E.	DLC-25	1050
8	40	G.E.	CD1441	250/1500
1	40	Cr. Wh.	CCM	700
1	35	G.E.	RLC-204	440/800
2	35	West.	SK-160	400
1	30	G.E.	RC-32	1100
1	30	West.	S-6	1025
1	30	West.	SA	975
2	30	West.	SA	500/1500
1	25	El. Dyn.	10-S	1500
2	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Rel.	92T	1150
1	25	West.	SK	900
1	25	G.E.	LC	900
1	25	Al. Ch.		850
4	25	G.E.	RF-12	500/1500
1	25	West.	SK	500/1500
1	25	G.E.	RF-11	500/1000
4	25	G.E.	RF-14	300/1200
1	25	G.E.	RF-14	300/900
1	25	West.	SA	325/975
2	20	West.	S	1300
1	20	R. & M.		1160
1	20	G.E.	CD-85	1150
1	20	G.E.	RC-11	1150
1	20	West.	SK-103	1200
1	20	West.	S-6	975
2	20	West.	SK-83	850
1	20	G.E.	RC	800
1	20	Al. Ch.	series	625
1	20	West.	HY-6	700
1	20	G.E.	RF-11	500/1500
10	20	G.E.	RF-12	400/1200
2	20	Star	SHB-30	29.2
2	16/25	Cr. Wh.	35-JA	400/1200
1	15	Roch.		3450
1	15	West.	SK-63	1750
4	15	Star	SQ-1520	1290
1	15	G.E.	RC	1200
1	15	West.	SK-80L	1100
1	15	G.E.	RC-29	1150
1	15	G.E.	RC-10	1150
1	15	G.E.	CDV-85	900
1	15	West.	SK	850
1	15	G.E.	CDE-83	850
2	15	G.E.	RC-30	850
2	15	G.E.	D	700
1	15	West.	SK	675/1350
1	15	G.E.	CQ	625
1	15	El. Dy.	5S	600/1200
1	15	G.E.	CQ	600/1500
1	15	West.	SK-100	600/2500
1	15	G.E.	LC	675/1150
1	15	Al. Ch.		400/1600
2	15	Rel.	155T	400/1600
1	15	G.E.	CD	400/1600
1	15	West.		400/1600
2	15	West.	SK-100L	500/1500
1	15	G.E.	RF-10	550/1000
1	15	G.E.	RF-11	400/1600
1	15	West.	SK	250/1100
1	15	Diehl		200/247
1	10	R. & N.		1300
1	10	West.	S	1325
1	10	G.E.	CD-75	1150
1	13	National	series	1100
1	10	G.E.	RC	1100
1	10	Triumph	TR-10S	860
1	10	G.E.	RC-29	850
1	10	Diehl	LS-14	750
1	10	West.	SK-7L	700
2	10	G.E.	CVC	700
1	10	Cr. Wh.	CSM	675
1	10	West.	SK	600/1200
2	10	G.E.	RLC	500/1500
1	10	G.E.	RF-10	400/1600
1	10	West.	SA	400/1200
1	10	G.E.	RF-10	400/1200
1	10	Rel.	131T	250/1000
1	7½	Sturt		3600
1	7½	L.A.	284	1750
1	7½	El. Dy.	2S	1750
2	7½	Rel.	235	1750
1	7½	West.	SK-30	1750
1	7½	G.E.	RC	1700
1	7½	West.	SK	1800
2	7½	Cr. Wh.	CCM	1425
3	7½	West.	SK	1100
1	7½	G.E.	RC	1100
1	7½	G.E.	CO-1804	1200/3200
1	7½	West.	SA	975
2	7½	West.	SK-50	975
1	7½	Cr. Wh.	SM	910
1	7½	G.E.	RC	900
1	7½	Cr. Wh.	CCM	875
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
1	8½	West.	SK-30	825
1	7½	G.E.	RF-10	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dy.	3S	550/1650
2	7½	L. A.	BW-15	525/1150
1	7½	Roth	RS-107	450/900
1	7½	West.	SK-70	400/1600
1	7½	West.	SA	400/1600
1	7½	G.E.	RLC	400/1600
1	7½	Al. Ch.		350/1050
1	5	Star	SB-5	1750
1	5	Rel.	T-254	1750
2	5	West.	SK-20	1800
2	5	G.E.	RC	1700
1	5	G.E.	CDV	1750
1	5	West.	SK-23	1750
1	5	G.E.	CVC	1650
4	5	G.E.	CVC	1100
1	5	G.E.	CD-65	1150
1	5	Rel.	32T	1150
8	5	G.E.	RC-27A	1150
2	5	West.	SK-43	1150
1	5	G.E.	B-284	1150
3	5	Cr. Wh.	CCM	950
1	5	West.	SK-23	920
1	5	West.	SC-3	870/1750
1	5	Rel.	23T	850/1700
1	5	Al. Ch.	E-75	850
1	5	G.E.	RC	600
1	5	Cont.	D-49	600/1800
1	5	Star	SB-10	600/1200
1	5	El. Dy.	3-S	550/1650
2	5	West.	SK-60	500/1500
1	5	Cr. Wh.	CM	400
2	3	G.E.	BD-235	3600

800—Smaller D.C. motors in stock including fractional.

110 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	60	Star	SQ-60L	1200
1	25	Star	15-L	2400
1	25	G.E.	CDM-95	1000
1	20	G.E.	CD-83	1750
1	16	Cr. Wh.	CMC-L	1750
1	15	West.		1150
1	15	El. Dy.	7½ S	615/1230
1	15	West.	S	560
4	10	Lincoln		3500
1	10	L. A.		3500
1	10	Al. Ch.	EBC-75	2175
1	10	G.E.	CD-73	1750
1	10	West.	SK-70L	850
1	10	Cont.		825
1	10	Rel.		400/1600
1	10	Diehl.		230
1	7½	I.G.E.		1300
1	7½	Cr. Wh.		1700
1	7½	Al. Ch.		1350
1	7½	West.	S	975
1	7½	G.E.	CVC	825
1	7½	El. Dy.	5 S	450/900
2	7½	Broomfield		1725
1	7½	West.	SK-294	84
1	7½	El. Dyn.	5S	600/1200
1	5	Kimble	BA-225	3500
1	5	Marathon		3500
1	5	West.	SK	1750
1	5	Diehl	DP-8	1750
1	5	West.	SK	1200
1	5	G.E.	CVC	1100
1	5	Burke	AB-5	1200
1	5/10	El. Dy.		300/1800
1	6	Burke	WAB-14	650
1	5	Cr. Wh.	CMC	600/1800
1	5	Imperial	D-35	500/750
1	5	Rel.		450/1800
1	5	West.	SK-70L	500
1	5	Watson	MW-15	350
1	5	El. Dy.	7½ S	260
1	5	Diehl		247
1	3	G.E.	RC	2100
1	3	F.M.	LA225	1200
1	3	Cont.	D-31	1150
1	3-3/4	Cr. Wh.		690
1	3	G.E.	CD-73	600/1600
1	3	Cr. Wh.	CMC	535/1050
1	3½	West.	SK	450/1800
1	3	El. Dy.	3S	450

600—Smaller size 110 V. D.C. motors including fractional horsepower motors also in stock.

SEND US YOUR INQUIRIES FOR A.C. EQUIPMENT

L. J. LAND, INC.

Established 1910 — **146 GRAND STREET, NEW YORK 13, NEW YORK** — **CAnal 6-6976**

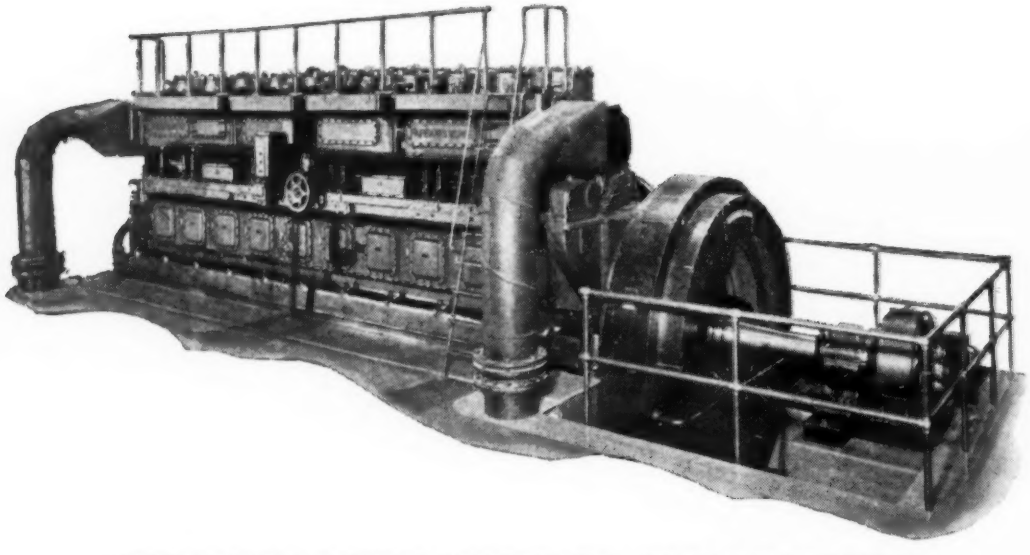
New England Representative
BOSTON, MASS., 411 Atlantic Ave.
Phone: Liberty 4300

Pennsylvania Office
READING, PA., 10th & Exeter Sts.
Phone: Reading 2-6866

2000 H. P. FAIRBANKS MORSE

1875 K.V.A. DIESEL POWER PLANT

Latest Model 33—240-480-2300 Volt



OTHER IMPORTANT OFFERINGS—PROMPT DELIVERY

HP	Model	KVA	RPM	New
2—2000	Fairbanks-Morse 33	1875	300	99%
6—1600	General Motors 16-278A	1200	720	90%
1— 690	Worthington	600	375	100%
2— 600	Fairbanks 33F	500	400	99%
1— 450	Fairbanks 33E	375	360	95%
1— 375	McIntosh Seymour	375	360	85%
1— 350	General Motors 8-268A	250	1200	85%
1— 150	General Motors 3-268A	125	1200	85%
1— 360	Fairbanks YVA	300	257	80%
2— 240	Fairbanks YVA	200	257	75%
3— 175	Murphy	141	1200	99%

ALSO PORTABLE GASOLINE UNITS

3 — 15 — 30 — 50 — 100 KW

Running Inspection on original foundations

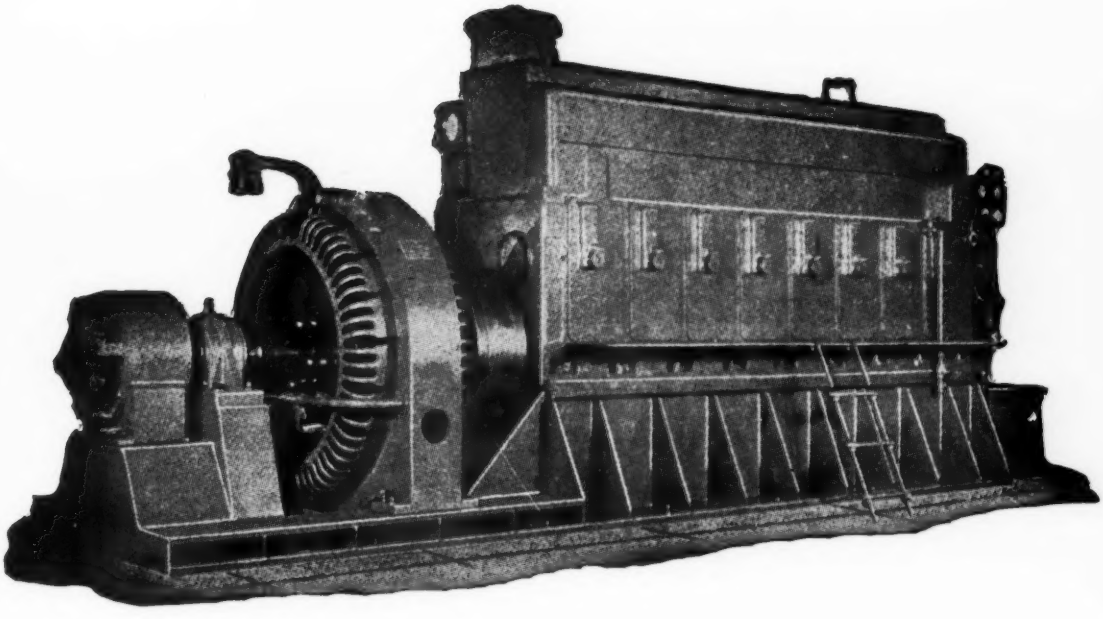
DIESEL MOTORS CORPORATION

PORT WASHINGTON, LONG ISLAND, N. Y.

ROSLYN 1600.

38 NEW BUCKEYE DIESEL ENGINES

DELIVERY TO-DAY



225-300-450 H. P.

4—5—8 Cylinder Model 80

10½ x 12—600 RPM.

ALSO COMPLETE GENERATOR PLANTS

150—200—300 KW

Some for Prompt Delivery

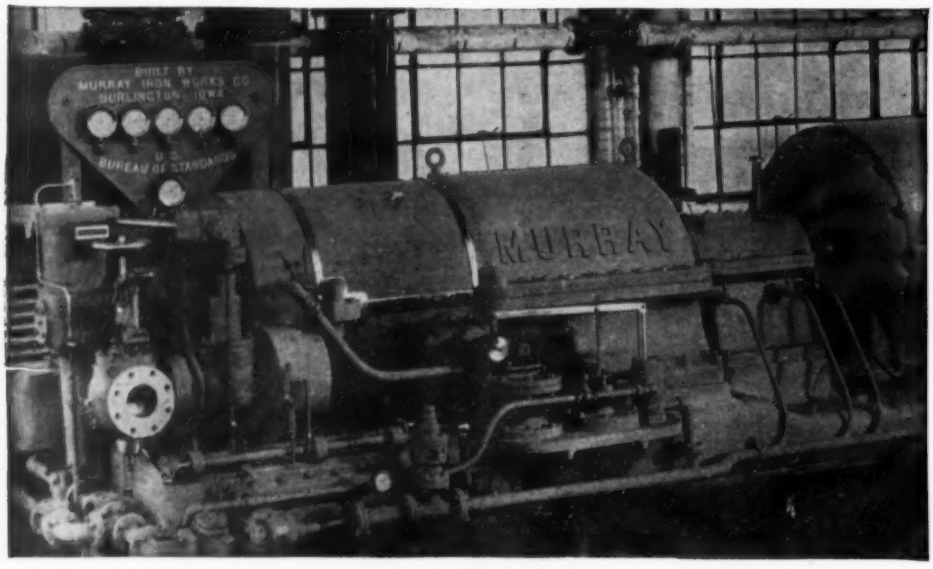
SEVERAL OTHER UNITS 100 TO 2000 HP

DIESEL MOTORS CORPORATION

PORT WASHINGTON, LONG ISLAND, N. Y.

ROSLYN 1600.

938 KVA AUTOMATIC BLEEDER CONDENSING TURBINE-GENERATOR UNIT



Actual Photograph

AVAILABLE

Immediate Delivery

938 KVA—750 KW 80% P.F., Allis - Chalmers 3 phase, 60 cycle, 2300 volts, 3600 RPM alternating current generator direct connected to a 750 KW, 3600 RPM Murray automatic bleeder condensing turbine 200 to 300 lbs. ISP, 500°TT, 10 to 20 lbs. gauge extraction pressure complete and equipped with surface condenser, condensing auxiliaries, exciter, switchboard and instruments. EXCELLENT CONDITION — A COMPLETE INSTALLATION.

TURBINE-GENERATOR UNITS
3 Phase, 60 Cycle

2500 KVA Allis automatic extraction condensing, 200 to 300 lbs. pressure, 2300/600 volts, 3600 RPM with exciter, condenser, switchboard.

2500 KVA G.E. condensing, 150 to 200 lbs. pressure, 2300 or 550 volts, 1800 RPM complete surface condenser.

2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, 3600 RPM, complete surface condenser, exciter.

1875 KVA Westinghouse condensing, 175 to 200 lbs. presure, 500° TT, 480 volts, 3600 RPM, complete.

1563 KVA G.E. automatic extraction condensing, 150 to 200 lbs. pressure, 480 volts, 3600 RPM with shaft exciter, condenser, switchboard.

625 KVA G.E. condensing, 200 lbs. pressure, 2300 volts, 3600 RPM complete exciter, condenser, switchboard.

625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back, 2300 volts, 3600 RPM, complete exciter, switchboard.

375 KVA G.E. condensing, 150 to 200 lbs. pressure, 100° SH, 2300 volts, 3600 RPM, complete with surface condenser.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts with exciter, switchboard.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM.

ENGINE-GENERATOR UNITS
Alternating Current
3 Phase, 60 Cycle

500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back pressure.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator, direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lbs. pressure, 6 lbs. back pressure.

225 KVA E. M. 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back.

180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18" x 21" Chuse non-releasing Corliss engine, 125 to 140 lbs. pressure.

150 KVA G.E. 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.

75 KVA Allis 2300/550 or 440 volt, 257 RPM generator direct connected to 12" x 16" Chuse 4 valve non-releasing Corliss engine.

ENGINE-GENERATOR UNITS
Direct Current

325 KW 35°—400 KW max. Crocker-Wheeler 125 volt, 300 RPM generator direct connected to Skinner vertical Unaflow non-condensing engine, 135 lbs. complete switchboard.

300 KW Westinghouse, 250 volt, 900-6012 RPM non-condensing turbine-generator unit 150- to 200 lbs. pressure, 10 lbs. gauge back.

75 KW Westinghouse, 125 volt, 1800 RPM non-condensing turbine gen.

75 KW Allis-Chalmers Terry, 125 volts, 2400 RPM non-condensing turbine-generator unit.

15 KW (2) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to an Am. Blower vert. engine.

SPECIAL OFFERINGS

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

750 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts alternating current generator direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

500 KVA Westinghouse, 3 phase, 60 cycle, 600 volts, 514 RPM, belted generator.

6000 sq. ft. C. H. Wheeler surface cond.

4238 sq. ft. Allis surface condenser.

125 KW, 125 volt General Electric direct current generator direct connected to 190 HP, 3 phase, 60 cycle, 480 volts, 1200 RPM General Electric synchronous motor complete.

75 HP G.E. 115 volt, 1200 RPM shunt wound direct current motor direct connected to 62½ KVA, 3 phase, 60 cycle, 2300 volt, 1200 RPM G.E. alternating current generator.

1—ALLIS-CHALMERS SYNCHRONOUS MOTOR GENERATOR SET CONSISTING OF: 1500 KW 550/600 volts, 300 RPM compound wound interpole direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volts, 300 RPM, A.C. motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

FIVE AIR COMPRESSORS

Available For Immediate Shipment

2—Schramm gas driven air compressor. Displacement 315 and 210 CFM, at a working pressure of 100#. Portable mounted on pneumatic tires with a spare set of steel wheels complete and self-contained. *Purchased in 1945.*

1—211 CFM Ingersoll-Rand Air Compressor, 100# Pressure at 325 RPM. Complete with Air Receiver. V-Belted to G.E. 30 H.P. motor type K-365, 3-60-220/440 Volts, 1800 RPM with compensator.

1—211 CFM Chicago Pneumatic Air Compressor, 100# Pressure at 325 RPM. Complete with After Cooler and Air Receiver, V-Belted to G.E. 30 H.P. motor type K-365, 3-60-220/440 Volts, 1800 RPM with starter.

UNIFLOW ENG. GEN. SET

1—300 kw Chuse vertical Uniflow engine generator set 6 cyl. 10 x 12 150# pressure O# B.P. 450 RPM D.C. to 300 kw G.E. Altemeter 3.60/2300 v. with D.C. exciter 125 v. Excellent condition. Rebuilt 1945. Reasonably priced for quick sale.

TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM, 145# pressure, 0-60 B.P.

GASOLINE DRIVEN POWER PLANT

1—35 KVA gasoline driven power plant, complete self-contained with panel board.

MOTORS

1—700 H.P. General Electric, Type KF Motor, 2300/60/3, 1800 RPM.

1—200 H.P., G.E. Synchronous Motor, 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

CENTRIFUGAL PUMPS

2—500 GPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—520 GPM, 50' head, DeLaval Centrifugal Pump, 2940 RPM, direct coupled to DeLaval Turbine, 200# pressure, 0-5# B.P.

1—4500 GPM, 135' head, LeCourtney Centrifugal Pump, 1800 RPM.

1—1800 GPM, 250' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

2—520 GPM, 50' head, DeLaval Centrifugal Pump, 1150 RPM.

AMMONIA COMPRESSORS

2—Frick 4 x 4 complete with 10 H.P., 1750 RPM, 3 phase, 60 cycle, 220/440 volt motor.

300 and 400 Ampere

ELECTRIC MOTOR DRIVEN ARC WELDERS

General Electric—Hobart—Lincoln

Reconditioned—Guaranteed—New 1943

WATER STORAGE TOWER

1—100,000 Gal. Water Tank mounted on 125 ft. structural steel frame, complete with standpipe and ladders.

CARRIER AIR CONDITIONING UNIT

1—30-ton Carrier Air Conditioning Unit. Complete including Kuthabar unit. Installed new in 1944. Used one season.

BUFFALO BLOWERS

19—Buffalo size 40 steel plate Blowers Type R. Flexibly coupled to Westinghouse motors 25 HP 3/60/220/440/1750 RPM. Explosion proof. Type CS 365.

HOISTS

2—15-ton Chain Hoists with trolleys.

GEAR REDUCER

1—Foote Bros. Gear Reducer, type 6HGS, 42 to 1 ratio.

MISCELLANEOUS

1—3600 sq. ft. CR. Wheeler Surface Condenser.

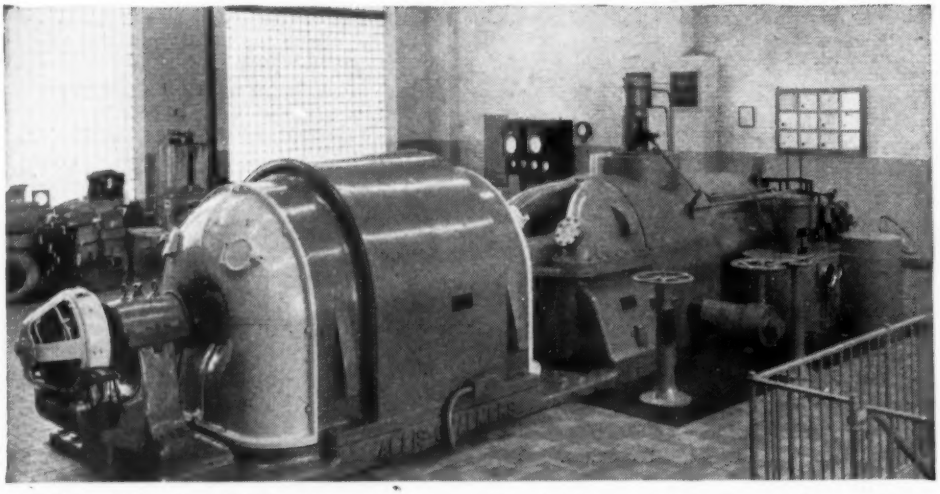
1—20-ton Box Crane, hand operated, 39 ft. span, complete

Heat and Power Co., inc.

70 PINE STREET | WHITEHALL 3-2172 | NEW YORK 5, N. Y.

TURBO GENERATORS

Diesel Engines: General Power Plant Equipment



300-lbs. ISP., 2500-KVA Allis-Chalmers Condensing Extraction 30#, Turbine-Generator.

Can be Given Running Test when Inspected

TURBINE-GENERATORS — IMMEDIATELY AVAILABLE

3750—KVA., G.E., 200#, 2300-V. Jet. Cond.
2—3750—KVA., G.E., Surf. Cond. 200#, 2300-V.
3125—KVA., G.E., Cond. 450# ISP. Surf Cond., 2300-V.
2500—KVA., West. Cond., 200#, 2300-V. Surf. Cond.
2500—KVA., Allis-C. Aut. Extr. 30#, 2300-V. 300#.
2500—KVA., G.E., Surf. Cond. 200#, 2300-V.
1—2500—KVA., G.E., Aut. Extr., 200#-ISP., 30# Ex. 480-V.
1875—KVA., Condensing, 200#, 2300-V.
1565—KVA., G.E., Surf. Cond., 150#, 2300-V.
2—1565—KVA., G.E., Auto. Extr. 30#, 200 ISP. 480-V.
1250—KVA., Allis-C. Non-Cond. 150#, 480-V.
1250—KVA., West. Surf. Cond., 200#, 2300-V.
937—KVA., Murray-Allis Aut. Extr., 30#, 300# ISP., 2300-V.
937—KVA., A.-C. Cond., 200#, 480-V.
937—KVA., Terry-Allis, Non-Cond. 50# BP., 200-ISP.
937—KVA., G.E., Cond. 175#, 2300-V.
937—KVA., Moore-Allis, Non-Cond. 25-BP 2300-V. 200" ISP.
937—KVA., A.-C. Non-Cond., 15#-BP. 150# ISP., 480-V.

CONDENSERS IN STOCK — IMMEDIATE DELIVERY

1—NEW 8280-sq. ft. Horizontal Surface Condenser, 2-Pass. Steel Shell. Capacity 70,000# steam per hour Top opening. Aluminum Brass Tubes, ¾"-OD., with or without Evactor. 28.5 Vacuum, with Surface inter cooler and after condenser. NEVER USED.

1—4500 sq. ft., Surface Type Condenser, 2-pass, Alberger. 1"-OD. Tubes, 28" vacuum. Capacity 36,000# steam per hour. Top opening.

Also Specialists in

DIESEL ENGINES, BOILERS, GENERAL POWER PLANT EQUIPMENT

DO YOU NEED ANYTHING NOW? SEND US YOUR SPECIFICATIONS

Have you any Turbine-Generators or other Power Plant Equipment for sale? We own Outright all machines which we offer.

CORRESPONDENCE INVITED

CHARLES WEAVER & COMPANY

Engineers

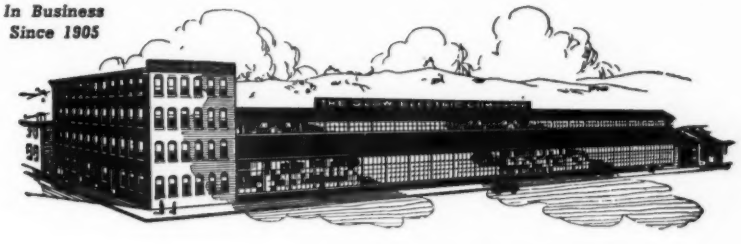
WIRE, WRITE OR TELEPHONE

4045 Penobscot Building, Detroit 26, Michigan

Telephones Cadillac 1340-1

GLOW ELECTRIC CO.

In Business Since 1905



SPECIAL—NEW PLATING GENERATORS

200 Amp., 10 to 15 volt, 1725 RPM, direct current, Master Plating Generators with overhung exciter.

MOTOR DRIVEN CENTRIFUGAL PUMP

Dayton Dowd, size 6x18 CSLF, rated 7250 G.P.M. 30 ft. head, at 685 RPM Centrifugal Pump mounted on common base and driven by:— Continental 75 HP, 695 RPM, 2200 volt, 3 phase, 60 cycle, drip proof motor.

COPPER OXIDE PLATING RECTIFIERS

500 Amp., 6 volts, Direct Current, for 440 volt, 3 phase, 60 cycle power, General Electric, Model 6RC120F2.

Note: Designed to be operated in series or parallel for higher voltage or current.

SIX NEW DIRECT CURRENT MOTORS

25 HP, 1750 RPM, 230 volt, compound wound, Marble-Card motors, Marine type, drip proof.

A. C. GENERATORS

(3 phase unless otherwise noted)

KW	P.F.	RPM	Volts	Description
3	1	1800	120/206	Hobart, 4 Wire, Ball Bearing
3.2	.8	1170	440	Westinghouse
4	1	1170	440	Westinghouse, Single Phase
7½	.6	1800	440	Electric Specialty, Ball Bearing
15	1	1800	127/220	General Electric, Single Bearing
20	.8	1200	120	Westinghouse, Single Phase, Ball Bearing
20	1	1800	110	Ft. Wayne, Single Phase
25	.8	1200	208/120	Westinghouse, Ball Bearing, New
40	8	1200	220	Burke, Single Bearing
50	.8	1200	120/208	Electric Machinery, Single Bearing, 4 Wire
60	1	300	2300	Fairbanks-Morse, Single Bearing
87½	.8	900	110/220	Starr, Single Phase
100	.8	900	200	Crocker-Wheeler
100	1	900	2300	General Electric
120	.8	257	2300	General Electric, Single Bearing
100	1	600	480	Burke
100	1	900	2400	Westinghouse
100	.8	1800	220	Westinghouse
150	1	600	480	Burke
150	.8	900	600	General Electric
150	.8	600	480	Crocker-Wheeler

NEW A. C. GENERATORS

5KVA, 1800 RPM, 120/240 volt, 1 phase, 60 cycle, Master Generators with overhung exciters—generators single bearing for direct connection to driving motor or engine. Complete with switchboard.

GAS ENGINE—AC GENERATOR SETS

2½ KW Leland, type A, frame 50, 1800 RPM, 120 volt, single phase, 60 cycle, AC Generator, with Briggs & Stratton, Model ZZ, 6 HP, 1800 RPM Gasoline Engine, U. S. Army PE75AA, complete with gas tank and tool box.

5 KVA Onan, .8 P.F., 1800 RPM, 110/220 volt, single phase, 60 cycle, AC Generator with Onan, twin, 4 cylinder Gasoline Engine complete with starting panel.

7½ KVA, 120 volt, 3 phase, 60 cycle, AC Generator with 4 cylinder Wisconsin Engine, U. S. Army PE99, type VE4-1, size 3 x 3¼, complete with switchboard panel.

10 KVA, 110/220 volt, single phase, 3 wire, 60 cycle, Westinghouse, AC Generator with water cooled Jeep Engine Drive, U. S. Army PE95, 4 cylinder. Complete with switchboard panel.

25 KVA Westinghouse, 20 KW, .8 P.F., 900 RPM, 120 volt, 1 phase, 60 cycle, AC Generator, with LeRoy Gas Engine complete with control panel.

31.25 KVA, 25 KW Westinghouse, .8 P.F., 1200 RPM, 208/120 volts, 3 phase, 60 cycle, AC Generator with LeRoy Gas Engine complete with control panel.

Note: In addition to the above Engine Generator Sets, our stock includes practically all sizes up to 35 KVA both AC and DC, some with Diesel Engine Drive.

WORM GEAR RIGHT ANGLE GEAR HEAD MOTORS

Janette, ½ HP, 1140 RPM, 440 volts, 3 phase, 60 cycle, ratio 38 to 1, output speed 30 RPM.

General Electric, ½ HP, 1725 RPM, 440 volts, 3 phase, 60 cycle, ratio 36 to 1, output speed 48 RPM.

General Electric, ¾ HP, 1750 RPM, 220/440 volt, 3 phase, 60 cycle, ratio 17½ to 1, output speed 99 RPM.

General Electric, ¾ HP, 1750 RPM, 220/440 volt, 3 phase, 60 cycle, ratio 36 to 1, output speed 48 RP.M.

Late Type TURBO-GENERATOR SET

Westinghouse 300 KW, 1200 RPM, 120/240 volt, compound wound, D.C. Generator with interpoles, directly connected to:

Joshua Handy Steam Turbine, 5965 RPM, for steam conditions of 440 lbs. per sq. inch gauge inlet pressure 28½" vacuum, 740 deg. F. total temperature. Including speed reducer, rheostat and balancer coil.

WELDER SETS

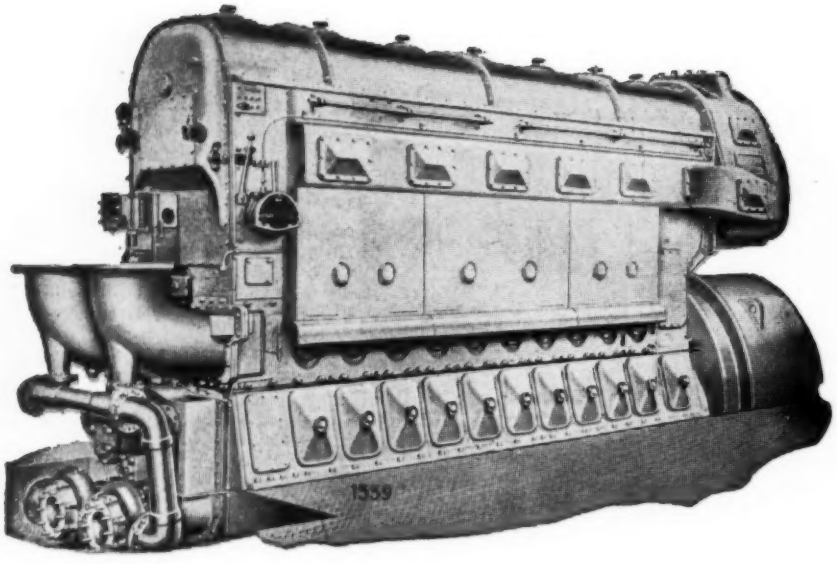
Amps.	Voltage	Manufacturers	Driven By
75	25	Hobart	3 HP, 220/440 V., 3 ϕ ph. 60 cy.
100	25	Lincoln	5 HP, 220 volt, 3 ph. 60 cy.
25	25	Ideal	7½ HP, 220 volt, 3 ph. 60 cy.
150	70	Arc Weld Mach. Co.	No Motor
150	45/35	Wilson Plastic Arc	7½ HP, 230 volt, Direct Current
150	25	Imperial	No Motor
150	6 arc capacity	Arc Weld Mach. Co.	30 HP, 220 volt, 3 ph. 60 cy.
175	55/25	Westinghouse	7½ HP, 220/440 V., 3 ph. 60 cy.
200	60/20	General Electric	1800 RPM—No Motor
200	60	Todd	7½ HP, 220 volt, 3 ph. 60 cy.
200	40	Lincoln	10 HP, 220 volt, 3 ph. 60 cy.
200	25	Lincoln	10 HP, 220 volt, 3 ph. 60 cy.
300	25	Westinghouse	15 HP, 230 volt, Direct Current Motor
300	25	Westinghouse	15 HP, 230 volt, Direct Current Motor
300	40	Wilson, single bearing for direct connection at 1800 RPM	
300	40	Lincoln	20 HP, 440 volt, 3 ph. 60 cy.
300	40	Lincoln, single bearing for direct connection at 1400 RPM	
300	40	Ideal	20 HP, 220 volt, 3 ph. 60 cy.
400	20	Wilson	No Motor
500	60	Westinghouse	45 HP, 220 volt, 3 ph. 60 cy.
1000	30	Westinghouse	50 HP, 220 volt, 3 ph. 60 cy.
1000	60	Westinghouse	92 HP, 220/440 V., 3 ph. 60 cy.
400	40	Lincoln	25 HP, 220 volt, 3 ph. 60 cy.

The items listed above are only a partial list of the large stock of electrical equipment which is available to meet your requirements.

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC HOISTS
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

933-943 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

ENGINEERED
AGSCO
DIESEL POWER



THREE—

1000 KVA, 800 KW, 3 phase 60 cycle, 2300 volt. Westinghouse, 600 RPM, Direct Connected to:—

3—1250 H.P. Fairbanks-Morse Diesel Engines, Model 38D8 ⅛, 10 cylinder, 8⅛" bore, 10" stroke, 600 RPM.

These three units are offered with complete equipment—switchboards, auxiliaries cooling equipment and silencing equipment

DIESEL GENERATORS

ALTERNATING CURRENT

KVA	MAKE	HP	MODEL	RPM	YEAR
2—1875	Fairbanks Morse	2000	33E16	300	1939
1—1250	Nelseco	1500	6M1-63	300	1931
4—1250	Fairbanks Morse	1700	38D8⅛	720	1944
12—1250	General Motors	1600	16-278-A	720	1944
3—1000	Fairbanks Morse	1250	38D8⅛	600	1944
1— 625	Superior	750	OS	327	1938
1— 312	Enterprise	450	D8G-8	450	New
1— 300	Fairbanks Morse	360	YVA	257	1928
1— 250	General Motors	300	8-268-A	900	New
4— 250	General Motors	400	8-268-A	1200	1945
6— 125	General Motors	200	3-268-A	1200	1944
1— 94	Buckeye	112	E	400	1936
4— 75	General Motors	90	6061E	1200	New
13— 62	International	75	UD18	1200	New
8— 37	General Motors	45	3-71	1200	New
15— 18	International	30	UD6	1200	New

Write for Bulletins

DIESEL ENGINES

AG SCHOONMAKER CO INC.

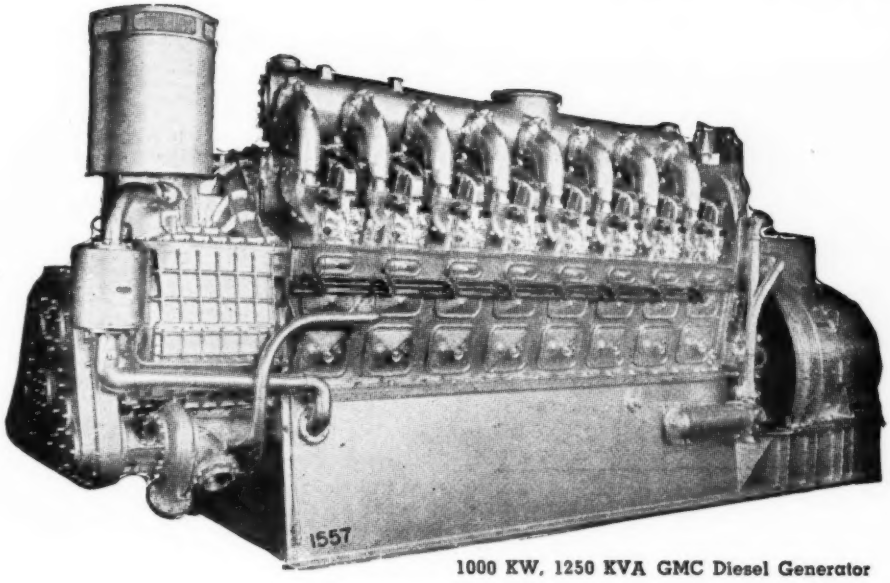
50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: WOrth 2-7225

Business Est. 1898

DIESEL POWER

ENGINEERED AGSCO DIESEL POWER



1000 KW, 1250 KVA GMC Diesel Generator

1000 KW, 1250 KVA Electric Machinery Mfg. Co. alternator, 3/60/2400, 720 RPM, direct connected to—

1600 HP General Motors Corp. Diesel engine, Model 16-278A, 2 cycle, 16 cylinders, V type, 8¾" x 10½", 720 RPM

(See data on facing page**)

OTHER IMPORTANT ALTERNATING CURRENT UNITS

KVA	MAKE	HP	MODEL	RPM	YEAR
4—75	General Motors	90	6061E	1200	New
13—62	International	75	UD18	1200	New
8—37	General Motors	45	3-71	1200	New
15—18	International	30	UD6	1200	New

DIRECT CURRENT GENERATOR SETS

KW	VOLTS	MAKE	HP	MODEL	RPM	YEAR
2—300	120/240	General Motors	450	6-278-A	750	New
1—275	120	Cooper Bessemer	440	FS-8	800	New
2—250	120/240	Enterprise	450	DSG-8	450	New
3—100	120/240	Superior	150	GDB-8	1200	New
1— 90	120	Winton	140	144	1200	1939
2— 60	120	General Motors	90	6-71	1200	1943
3— 15	120	Hill	30	4C	1200	1940
2— 12	120	Hill	25	4R	1200	1939
2— 10	120	Hill	20	4R	1200	1940

WRITE—WIRE—PHONE

MAKER CO INC.

BUSINESS ESTABLISHED 1898

NEW YORK 7, NEW YORK

PHONE: WOrth 2-7225

DIESEL POWER

LIQUIDATION SALE

POWER EQUIPMENT OF MODERN SHIPS

(MOST EQUIPMENT 3 TO 4 YEARS OLD)

DIESEL ENGINES

2—300 HP Fairbanks Morse Model 38 O.P. 6 cyl., 2 cycle 5"x8" 1200 RPM (built 1938)

2—350 H.P. Superior Diesel Ser. #10501 & 10529, Type VD. MB, 8 cyl., Bore 9", Stroke 12", 600 R.P.M., built 1939

4—1800 H.P. General Motors 16-258S, 16 cylinder, 9½" x 12", 2 cycle, Buchi supercharged 900-750 RPM (new 1943)

2—1600 H.P. (HOR) Hamilton 9 cylinder, 2 cycle, 800 RPM, reversible (new 1944)

2—500 H.P. General Motors 8-268A, 8 cyl., 6½" x 7", 2 cycle, 1200 RPM (new 1943)

The above engines can also be supplied with fluid couplings, reduction gears and all other equipment suitable for ship installation.

DIESEL GENERATORS

4—1200 KW, DC, Allis Chalmers, 525 V. 750 RPM Driven by 1700 HP General Motors Diesel 16-278A 750 RPM (New 1943)

2—200 KW, AC, 3/60/440 and 40 KW, DC, 120/240 V Driven by 500 HP General Motors Diesel, 8-268A, 8 cyl., 6½" x 7" 2 cycle, 1200 RPM (new 1943)

1—375 KW, DC, 180/220 V, Driven by 500 HP General Motors Diesel 8-268A, 8 cyl. 6½" x 7" 2 cycle, 1200 RPM (New 1943)

8—60 KW, DC 250 V, driven by 90 H.P. General Motors Diesel 6-71, 6 cylinder, 4½" x 5" 1200 RPM. New 1943

2—20 KW DC 250 V, driven by 30 H.P. General Motors Diesel 2-71, 2 cylinder, 4½" x 5" 1200 RPM. New 1943

2—60 KW DC Generator, 250 V. driven by 110 H.P. Buda Diesel, 8 cylinder, 4 cycle. New 1944

All auxiliary equipment can be furnished.

MOTORS

28—DC 1500 HP, W'hse, 525 V, 600 RPM

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 60 HP, 120 V, various speeds

18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1/3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle, 1700 V, 257 RPM

HOISTS

6—Mead Morrison Co., 2 drum hoisting engines type H-97, driven by 51 HP G.E. motor 230 V, DC

5—Mead Morrison Co., single drum derrick swingers type 138, driven by 5 HP G.E. motor 230 v, DC

NOTE: The above hoists are complete with controllers

2—Jaeger Utility hoists, single drum, driven by Continental 6 cylinder gasoline engine

TURBO-GENERATORS

6—4600 KW G.E. 3 phase, 93 1/3 cycle, 2700 V, 5600 RPM (or 2900 KW, 60 cycle, 1700 V, at 3600 RPM), 410# cond., complete with 3800 sq. ft. condensers, amplidyne motor generators, circulating and condensate pumps, etc.

7—600 KW (New) G.E. Type ATI 3/60/450, 1200 RPM with exciter cond. (built 1944, never used)

9—300 KW G.E. type ATI 3/60/450, 1200 RPM, cond., compl. with 40 KW exciters, condensers, switchboards.

8—200 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—375 KW West'hse, 180 #220 V, DC, 3000 Amp, 1200 RPM, cond.

1—300 KW 120/240 V.D.C. 1200 RPM,

12—150 KW West'hse type SK, 120 V, DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V, DC, 1800 RPM, cond.

NOTE—MANY GENERATORS FOR SALE SEPERATELY WITHOUT TURBINES

MOTOR—GENERATORS

AC to DC and DC to AC—various sizes from 1 HP to 80 HP.

GERNERATORS

28—1200 KW DC Allis Chalmers, 525 V, 750 RPM

TURBO-BLOWERS

9—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

CONDENSERS

10—4500 ⅝" tubes—surface 8463 sq. ft.

10— 400—⅝" tubes—surface 280 sq. ft.

SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers, switches, meters, recorders, etc, etc.

TRANSFORMERS

5—50 KVA 3—10 KVA
15—25 KVA 5— 3 KVA
} from 440 V to 120 V, all single phase, 60 cycle, dry type

BOILER

6—Express Boilers, modified D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

2—B & W Water tube boilers, 24000 steam hr. 250# design pressure, oil burners, superheaters, etc.

BOILER FEED PUMPS, TURBINE DRIVEN

1—DeLaval 675 GPM 725# dischge., 4900 RPM, steam 540#

1—DeLaval 600 GPM 575# dischge., 4600 RPM, steam 400#

2—Worth'ton 750 GPM 375# dischge., 3500 RPM, steam 240#

5—Ing. Rand 165 GPM 575# dischge., 4850 RPM, steam 375#

3—DeLaval 125 GPM 575# dischge., 7000 RPM, steam 400#

4—Worthington 90 GPM 550# discharge equipped for Motor drive.

CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze, motor and turbine driven.

RECIPROCATING STEAM PUMPS

50—Simplex and duplex, various sizes, bronze and steel

CENTRIFUGES

15—Sharples
15—DeLaval
} Oil purifiers and oil clarifiers, capacity 180 GPH and 150 GPH, with motors and pump

HIGH PRESSURE AIR COMPRESSORS

2—Ingersoll Rand type 40, 4 stage, 3000# press. 20 cft. driven by G.E. 3/60/220/440 motors 50 HP

1—same, driven by Waukesha gas engine model GBZ 1111

2—Ingersoll Rand class B, 3 stage, 3,000# press. 7½ cu. ft., driven by G. E. 3/60/440 motors, 24 HP.

DISTILLING PLANTS

2—Griscom Russell Soloshell double effect, 8000 gals. per 24 hours. complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

FANS

150—from 3,000 to 16,000 CFM at 2" to 3" S.P. with AC and DC motors.

FUEL OIL HEATERS

24—Griscom Russell sect. G-fin, 86 sq. ft.
1—Griscom Russell 4 sect., 6 fin.

FEED WATER HEATERS

1—Bath Iron Wks, 95# press. 546 sq. ft.
2—Bethlehem 415 sq. ft.
10—Schutte & Koerting type L, 300 sq. ft.
12—Struth. Wells, 6 pass., H.P., 286 sq. ft.

WRITE OR CALL FOR DETAILS

HUGO NEU CORPORATION

31 Nassau Street New York 5, N. Y.

Tel.: REctor 2-1334

ARRANGE FOR INSPECTION

1500 KW G.E. EXTRACTION-CONDENSING UNIT

150/250# initial—20# ga. auto. extraction—60/3/480 v. rewound
Surface Condenser—all auxiliaries—complete—good condition

3000 KW WESTINGHOUSE CONDENSING TURBO GENERATOR

200# 100°—60/3/2400—4160Y—Surface Condenser
Turbine—46 CW Frame—rebuilt—all in excellent shape

FURNACE TRANSFORMERS

3φ 1500 KVA—12000 primary—rebuilt
3φ 4000 KVA—22000 primary—new
3φ 4000 KVA—22000 primary—new—1944
3φ 4000 KVA—13200 primary—new—1944
1φ 3600 KVA Bank—13200 primary—new—1944
1φ 150 KVA (2 units) 1200 primary w/Scott taps
3φ200 KVA 230 primary—120/60 secondary
New—with voltage regulator

VERY GOOD EXTRACTION-CONDENSING MACHINE—CAN SHIP QUICK

1000 KW—0.8 p.f.—250# 550° 25# g. extraction—60/3/480 11 stage turbine—double bucketed in high—13.5#/KWH condensing W.R.—direct connected exciter—surface condenser switchgear—Built 1929—mate duplicate installation—regular maintenance and renewals.

FOR YOUR FUTURE PLANNING—AVAILABLE SUMMER 1947

10,000 KW 0.8 p.f.—200# 500° 35# g. extraction—60/3/2400 semi-double flow—turbo built about 1915-16 but completely overhauled and reconditioned 1943—excellent physical condition—surface condenser, all auxiliaries, switchboard, etc.—extraction uncontrolled.

STRAIGHT—CONDENSING TURBO SET 450# 650°

1500 KW—0.8 p.f.—60/3/240—built 1928—surface condenser all auxiliaries—reported excellent physical condition.

TURBO ALTERNATORS

Condensing

300 KW 240 V 150# 100° Surf Cond (new 1929) factory rebuilt
1000 KW (3 units) 2400 V 150# 100° Jet Cond (new about 1922)
1250 KW 2400 V 200# 100° Surf Cond (new 1924)
1500 KW 480 V 200# 100° Jet Cond (new 1920)
2000 KW 600 V 200# 100° Jet Cond (new 1920)

Non-Condensing

100 KW 240 V 175# 100° ISP 0 to 5# g. BP (new 1921)
500 KW 480 V 175# 100° ISP 5 to 20# g. BP (new 1920)
1500 KW 2400 V 175# 100° ISP 10# g. BP (new 1926) rebuilt
1500 KW 240 V 400# 650° ISP 90# g. BP (new 1928)

DC TURBO UNITS

750 KW 250 V 16#/165# (M.P.) Jet Condenser
500 KW 250 V 16#/165# (M.P.) Condenser
150 KW (2 units) 250 V 225# 25# g. BP modern design

ENGINE GENERATORS

60 cycle 3 phase

400 KW 480 V Allis Corliss 175# 150° ISP 25# (new 1924) excellent unit
600 KW 2400 V Chuse Uniflow 200# C or NC (new 1922)

DC ENGINE SETS

200 KW (3 units) 250 V DC Hamilton Corliss left hand
250 KW 1250 V DC Erie Ball built 1916 (2 units)

BOILERS

Water Tube

365 HP (2 units) 200# 100° Stokers Edgemoor str tube (new 1923)
600 HP (2 units) 160# pulverized firing—sect'l hdr. Pennsylvania
400 HP 400# 650" sect'l hdr (new 1928)

Fire Tube

90 HP 118# stoker equipped ASME Mich. Code HRT
250 HP 125# grates and stack non-code Scotch Marine
125 HP (ten units) 300# Oil Country Boilers ASME Code
400 HP—2 units—Scotch Marine ASME Code—150#
And a few modern 450-500-700 psi Generating Units

DIESEL ENGINE GENERATORS

60 cycle 3 phase

400 KW/600 HP 480 V Clark 2 cycle vertical 400 RPM
375 KW/560 HP 2400 V Fairbanks Model 33, 257 RPM
540 KW/800 HP 480 V 4 cycle 6 cylinder 360 RPM new units
465 KW/700 HP 2400 V Fairbanks Model 33, 257 RPM
440 KW/650 HP—2400 v. ENTERPRISE—rebuilt—guaranteed
1500 KW—Plant complete—Fairbanks-Morse—fair condition

POWER UNITS

180 HP Fairbanks Model 32E12 (new unit)
225 HP Buckeye 6 cylinder 400 RPM complete (new 1941)

MOTOR GENERATORS

190 KW: 60/3/440 Synchronous, 25/80 V DC with exciters, panel, controls
1160 HP/750 KW—13,200A.C., 250 D.C.—514 RPM—Complete
3500 KW: 60/3/13200 Synchronous, 250 V DC, with exciters

FREQUENCY CHANGERS

3125 KVA 60/3/2300—25/3/2300—complete

BOILER PLANT

300 HP 200#—gas fired—water treatment—building—stacks—excellent

TRANSFORMERS

100 KVA to 4000 KVA 69, 44, 33, 22, 13.2, 2.4 KV primaries

PAUL STEWART & CO., INC.

UNION TRUST BUILDING . . CINCINNATI 2, OHIO

Over 50 Years of Service

Wexler

Electric Motor Co., Inc.

210 LAFAYETTE STREET
NEW YORK CITY

PHONE—CANAL 6-3297-8-9

MOTORS! CONTROLLERS! GENERATORS!

OUR SPECIALTY

BUILDING ANY M.G. SET TO YOUR SPECIFICATIONS — CUSTOM MADE

NEW—Drip Proof-B. B., Navy Insp. and Approv.

115 V.—D.C.

25	Star	1750	
20	Star	1750	
15	Star	1750	
10	Star	1200	
10	Star	1750	
7½	Star	1200	Tot. enc.
5	Star	1750	

230 V.—D.C.

5	G.E.	1200	Tot. enc.
3	G.E.	1200	
7½	G.E.	1750	
15	G.E.	1200	Tot. enc.

115 V.—D.C.

25	Western	1150	
25	C.W.	400	
15/27	G.E.	4/1600	
12½	Kimble	8/1400	
15	Sprague	365	
15	G.E.	1000	
15	West.	1150	
15	G.E.	1200	
10	E. Dyn.	4/800	
10	E. Dyn.	850	Tot. enc. BB
10	G.E.	1200	
10	G.E.	1200	
8½	G.E.	2400	BB
7½	G.E.	425	
7½	West.	600	
7½	G.E.	900	
7½	Al. Chal.	1750	
7½	G.E.	1750	
5	G.E.	1200	
5	G.E.	1750	

D.C.—230 V.

50	C.W.	700	
30	West.	700	
30	G.E.	1200	
25	West.	700	
25	West.	900	
20	West.	650	
20	Sprague	750	
20	G.E.	1200	
15	G.E.	850	
15	G.E.	850	BB
12½	G.E.	9/1160	
14½	Star	1290	BB Tot. enc.
15	G.E.	1200	
15	Diehl	1725	
15	G.E.	3450	Vert.
10	G.E.	1750	Tot. enc.
10	G.E.	1200	
10	West.	850	
7½	West.	650	
7½	Diehl	900	
7½	West.	1200	
7½	G.E.	1750	

NEW GENERATORS

to 25 HP.—115 V.—D.C.—900 & 1400 rpm.—Drip proof—Ball Bear. Navy Insp. & Approved.

Slipring—Hoist

100	G.E.	700	25 cy. 2 shifts
80	G.E.	1200	2 shifts
60	G.E.	710	25 cy.
50	G.E.	1150	2 shifts
40	G.E.	600	Tot. enc.
40	G.E.	750	25 cy.
40	P. Harn.	900	2 shifts
35	G.E.	600	550 V.
30	G.E.	600	550 V.
30	G.E.	850	Sq. Cage
30	G.E.	1040	Sq. Cage
20	G.E.	660	
15	G.E.	830	
15	West.	1725	Sq. Cage
10	G.E.	700	

Variable Speed—230 V.

20	Sprague	750/1500	
20	El. Dyn.	450/1550	
15	El. Dyn.	225/1350	
15	West.	6/1200	
15	West.	5/1500	
10	G.E.	4/1600	
10	G.E.	6/1800	
10	G.E.	850/510	
10	Al. Chal.	5/1500	
10	Reliance	5/1500	
7½	G.E.	5/1500	
7½	G.E.	350/400	
7½	E. Dyn.	450/1350	
7½	E. Dyn.	225/380	
7½	Imperial	750/1200	
5	West.	4/1200	
5	Ideal	750/1100	
5	C.W.	575/850	
5½	West.	6/1800	
5	Watson	5/1500	
3	West.	5/1000	
3½	G.E.	4/1350	
3	G.E.	13/1700	BB

GEAR REDUCERS
CONVERTERS

Slipring—2 & 3 Ph.

300	West.	1160	
220	G.E.	720	2200 V.
60	G.E.	900	
50	Imperial	850	Dr. prf.
50	Cleve.	1200	BB
30	G.E.	1200	
40	West.	900	
40	G.E.	900	
35	West.	1160	
35	G.E.	1800	Syn.
35	C.W.	860	
35	G.E.	900	
30	Imperial	850	Hi-tor.
30	West.	1750	
30	Lincoln	900	
30	Wagner	1150	
25	G.E.	600	
25	G.E.	750	25 cy.
25	West.	900	
25	G.E.	900	
25	G.E.	900	2200 V.
25	Howell	900	
25	C.W.	1200	
25	Wagner	1200	
20	Al. Chal.	900	550 V.
20	West.	600	
20	G.E.	600	
20	G.E.	695	
20	G.E.	720	
20	Burke	900	
20	El. Mach.	1200	Sp. prf.
20	Fl. Weish.	1200	
15	West.	600	
15	G.E.	750	25 cy.
15	West.	715	25 cy.
15	No. West.	840	
15	Wagner	850	
15	G.E.	850	
10	G.E.	850	550 V.
10	Imperial	850	
10	G.E.	900	
10	Esco	1800	2 shfts.
11	West.	850	
10	Al. Chal.	1200	
7½	Century	750	Drip prf

BLOWERS—FANS

SPECIAL

100 KW—GE—720 rpm Synchron. Drive. Complete with control panel & starting panel.

The recommendation of our many satisfied customers is more important to us than the initial sale.

■

ONE YEAR GUARANTEE

All equipment is carefully rebuilt by experts and GUARANTEED for ONE YEAR against electrical and mechanical defects.

■

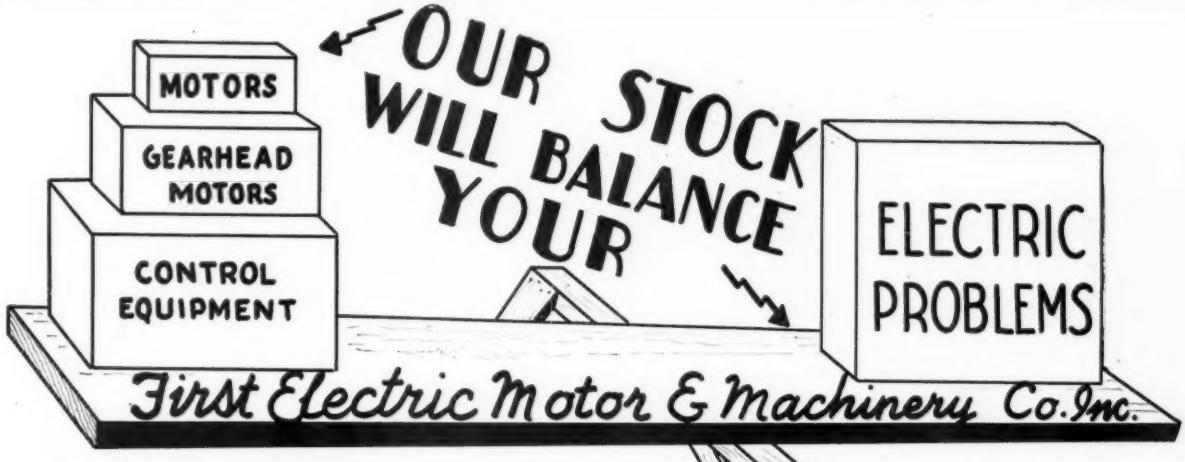
We invite your inquiries and surplus lists.

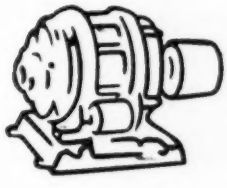
Squir. Cage—2 & 3 Ph.

350	Lincoln	1200	2300
200	Western	600	2300
150	Al. Chal.	695	2300
50	West.	900	
50	West.	735	25 cy.
50	West.	690	
100	West.	1750	
100	Hawthorne	720	
100	G.E.	900	Syn.
75	Reliance	1750	BB
75	West.	850	
60	G.E.	3600	Vert.
50	Al. Chal.	900	
50	West.	3450	
40	West.	600	
40	G.E.	900	
40	Century	1800	
40	G.E.	1800	
35	G.E.	660	
30	Imperial	580	Lines
30	West.	1740	
30	West.	1200	
30	West.	900	
25	G.E.	600	Vert.
25	C.W.	685	
25	G.E.	900	
25	Diehl	900	
25	Triumph	860	
25	G.E.	875	Vert.
25	Howell	900	Vert.
25	Wagner	1140	Vert.
25	Al. Chal.	1750	
25	U.S.	1800	Dr. prf.
25	West.	1750	
25	Lincoln	1800	2200 V.
25	G.E.	690	2200 V.
17	G.E.	690	
20	G.E.	900	
20	G.E.	1200	BB
20	Cleve.	850	
20	G.E.	900	
20	Wagner	600	550 V.
20	Cent.	1730	
20	West.	1130	
20	Wagner	1200	1 phase
20	G.E.	1725	550 V.
20	G.E.	1750	
20	Western	1200	
15	Lincoln	715	25 cy.
15	West.	900	
15	Lincoln	1200	
15	G.E.	1750	
15	G.E.	1200	
15	Lincoln	1200	
15	G.E.	1800	
15	West.	1750	
15	G.E.	1200	550 V.
15	West.	900	
15	Howell	685	550 V.
10	G.E	720	550 V.
10	Wagner	1150	BB
10	G.E.	1800	BB New
10	G.E.	1800	Synch.
10	F. Weish.	17/690	
3/12	L. Allis	1200	
10	West.	1200	BB
10	Star	1200	
10	G.E.	750	Drp. prf.
7½	Century	870	

GEAR HEAD MOTOR

30 H. P.—GE—1750 rpm to 194 rpm—115 Volts D.C.—cpd.—type CD85—ratio 9:1.





MOTORS

Qu.	HP	Speed	Type
200	½	900 220/440 v B.B.	Expl. Proof Wagner rebuilt nema
19	150	1800 B. B. Howell rebuilt nema	440
4	150	1200 440	new Ball Bearing T.E.F.C.

SYNCHRONOUS MOTORS

3—300 HP GE 12000 RPM 2300 V. 60 Cycles—3 Phase

SLIP RING

5—50 HP L.A. Drip proof 220/440/60/3 BB. 900 RPM
500 HP F.M. 4800/2400/60/3 BB. 1800 RPM

NEW MOTORS

Qu.	H.P.	Speed	Type	
4	15	3600	Open	
16	1	900	Open	
1	1	1200	TEFC	
10	1	3600	TE	
1	1½	900	Open	
5	1½	1800	TE	
5	2	1200	TEFC	
4	3	900	Open	
10	3	1200	Open	
12	3	1200	Open	
2	3	1200	TEFC	
5	3	1200	TEFC	
16	7½	900	Open	
3	7½	1200	TEFC	
7	7½	3600	Open	550 volts
8	10	900	Open	
3	15	900	Open	
2	15	1800	Open	
2	20	1800	TEFC	
5	25	3600	Open	
5	30	1200	Open	
3	30	1200	TEFC	
3	30	3600	Open	
4	40	1200	TEFC	
3	40	3600	Open	
2	50	1800	TEFC	
4	50	3600	Open	
7	60	1800	TEFC	
4	60	1800	Splash Proof	
3	100	1200	TEFC	
2	150	1800	TEFC	
1	150	1200	TEFC	
3	200	1800	Open	
1	200	1200	Open	
10	40	1200	Open	

USED MOTORS

Qu.	HP	Frame	Speed	Make	Type
1	½		3600	G.E.	TE
5	1		3600	Wagner	TE
7	1		3600	Howell	TE
1	1	203	1800	G.E.	Open—slip ring
1	1	204	1200	F.M.	TE
2	1	204	1200	Howell	TE with brake
2	1	204	1200	Westhse.	TE with brakes
1	1	204	1200	Delco	TE double shaft
2	1	225	900	Delco	TE doubl shaft
1	1½	203	3600	Westhse.	Open vertica

Qu.	H.P.	Frame	Speed	Make	Type
1	1½	204	1800	Reliance	Open
1	1½	224	1200	Westhse.	TE double shaft
1	1½	224	1200	F.M.	TE
1	1½	254	900	Reliance	Open
1	2	224	1800	Westhse.	Open dbl. shaft
1	2	224	1740	Delco	Open
1	2	224	1740	Delco	Open
1	2	225	1200	Westhse.	TE no fan
1	2		600/1200	Wagner	TE two speed
14	3	224	3600	Wagner	TE
1	3	225	1800	L. Allis	Open
1	3	225	1800	Wagner	TE
1	3	254	1200	G.E.	Open
1	5	225	3600	U.S.	TEFC
2	5	225	3600	Wagner	TE
1	7½	254	3600	Wagner	TE
1	7½	254	3600	Wagner	TE
1	7½	254	3450	G.E.	TEFC
1	7½		900/1800	Wagner	Open two speed
1	7½		284	Master	TEFC gearhead
1	10	284	3600	G.E.	Open
1	10	326	1080	Wagner	TE hi slip hi torque
1	20	364	1800	Delco	TEFC
1	25	364S	3600	Howell	TE
1	30	365S	3600	Westhse.	Open
1	40	445	1200	L. Allis	TE
2	40		600	L. Allis	Sp Prf with brake
1	50	505	900	G.E.	Open
2	125	10858	1800	F.M.	Open
1	125	666	1200	Howell	Open hi slip hi torque
9	150	684	1800	Howell	Open
1	200	262	1800	Wagner	Open

Quan.	H.P.	Voltage	Reduced Voltage
50	125	220	Compensator
50	75	220	Comps.
10	50	220	Comps.
15	100	220	Comps.
6	150	220	Comps.

FOUR SPEED MOTORS—USED

1	2-1.33-1-.67	1650-1120-850-545	G.E.	Open, vertical no shaft, · spec. motor

FOUR SPEED MOTOR

Qu.	H.P.	Speed	Make	Type
1	1½-1¾-1 2 18/12/9/6		G.E.	TE
4	2½-3¾-	600/900/1200/1800		
5-7½			Wagner	TE four speed

TWO SPEED MOTORS

Qu.	H.P.	Speed	Make	Type	
13	1-1½	1800/900	Wagner	TE	
1	2½-5	1800/900	Delco	Open	
1	15-10	1800/1200	Westhse.	Open	
1	25-17	1800/1200	G.E.	Open	tri-clad
2	60-30	3600/1800	Wagner	TE	

USED—GEARHEAD MOTORS—*USED*

H.P.	RPM	Make	Type	Volts	Amount
1/8	18	Master	Open	110/220 1 ph	1
1/6	19	Master	Open	440	3
1/6	197	G.E.	Open	440	2
1/4	9.6	Master	Open	110/220 1 ph	2
1/4	175	Master	Open	220	1
1/4	86	Janette	Open	550	3
1/4	36	G.E.	Open	440	3
1/4	17.5	G.E.	Open	220/440	1
1/4	86	Janette	TEFC	550	2
1/4		B-Line	Open	110 1 phase	1
1/2	3	Master	TEFC	220/440	1
1/2	612	Master	Open	220/440	1
1/2	350	Master	TEFC	440	1
1/2	17.8	G.E.	Open siprg	220	1
1	438	Master	Splash Proof	220/440	1
1	280	Master	Open	550	1
1	288	Master	TEFC	220/440	1
1½	346	G.E.	TEFC	220/440	1
2	312	Master	TEFC	220/440	1
3	276	G.E.	Open	220/440	1
5	18	Janette	Open	440	1
20	420	Master	TEFC	220/440	8

FOUR SPEED MOTORS

3	42	—			
1½	21	—			
1½	10.4	Master	Open	220 with brake	3
3/4	5.5				

NEW—GEARHEAD—*NEW*

H.P.	RPM	Make	Type	Volts	Amount
1	5.32	Star	Open	220/440	2
1½	190	U.S.	Splash Proof	220/440	1
1½	350	Westhse.	Open	220/440	1
1½	125	Westhse.	Oper	220/440	1
3/4	280	U.S.	Open	220/440	3
2	118	U.S.	Splash Proof	220/440	1
2	350	Westhse.	Op	220/440	2
2	68	U.S.	Splash Proof	220/440	1
2	350	Westhse.	Open	220/440	1

NEW NEMA BASES

20-203	20-225	20-326	20-405	20-504
20-204	20-254	20-365	20-444	20-505
20-224	20-284	20-404	20-445	

WRITE-WIRE-PHONE YOUR INQUIRIES TO

First Electric Motor & Machinery Co., Inc.

MONROE 1388-1389 P. O. BOX 1273 ROCHESTER 7, N. Y.

1132-38 MT. HOPE AVE.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 phase—25 cycle—220/440 volt

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871.52C	1460
125	West. (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	450

MOTORS
3 phase, 60 cycle, 220/440 Volts

HP	Make	Type	RPM	Serial No.
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	9445931
20	Westinghouse	CS	1200	2160500
20	Westinghouse	MS	1200	1050826
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	2695044
20	Westinghouse	CS	1200	2160590
20	Westinghouse	MS	1200	1056826
20	Westinghouse	CS	1800	1863526
25	Westinghiuse	MS	1800	1562026
25	Westinghouse	CS	1200	2386768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CS	900	1898969

HP	Make	Type	RPM	Serial No.
40	General Electric	I-K	1800	73318
40	Westinghouse	MS	1800	1506806
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
40	General Electric	I-K	1800	73316
40	Westinghouse	CCL	1800	1506800
40	General Electric	I-K	1200	181444
50	Westinghouse	CS	1800	1949877
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	General Electric	14	1800	181444
50	General Electric	KT-352	720	
50	Allis Chalmers		1800	3K28825
60	Reliance		1200	B11458
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Whse. 2200V.	CCL	1200	854121
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CCL	1200	
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CS	1200	2318625
125	Westinghouse	CCL	1800	765231
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	General Electric	I-K	1200	
150	Whse. 2200V.	CCL	720	808349
150	Westinghouse	CS	1800	2429726
250	General Electric.	I-K	600	2246834

230-VOLT D.C. VAR.

HP	Make	Type	RPM
1½	Westghse. (9)	SK	740/2200
1½	G.E.	RA6	500/1500
1¾	Westghse.	SK	1150/2200
2	G.E.	RC24	2040
2¼	G.E. (2)	RA30	400/1350
2½	Westghse.	SK	460/1800
3	G.E. (5)	CD55	850/1350
3	G.E.	CD	850/1350
3	G.E.	DD55	850/1350
3	G.E.	CD	850/1350
3½	Westghse.	SK	450/1600
3½	Westghse.	SK	450/1800
3½–4½	Westghse. (4)	SK	175/1800

H.P.	Make	Type	RPM
3¼	Sprague	M2 Crane	655
3¼–5½	Westghse. (2)	SK	500/1500
3½–7½	Westghse. (2)	SK	450/1500
3½–6¾	Westghse. (4)	SK	450/1500
3¾–7½	Westghse.	SK	450/1500
5	Star	SB3	1150
5	Westghse.	SK	1600/2800
5	Reliance		500/1000
5	G.E.	RF9	450/1800
5	G.E.	CD55	1750
5½	Westghse. (22)	SK	500/1500
5	Westghse.	SK	500/1500
5½	Westghse.	SK	400/1600
7½	Westghse.	SK	500/1500
7½	Westghse. (4)	SK	1340/2680
7½	G.E.	CVC113	1675
7	G.E.	RF10	480/1600
7½	G.E.	CD55	1750
10	Westghse.		1200/1800
10	G.E.	LC	750/1200
10	G.E. (3)	LC	750/2000
10	G.E.		425/1275
10	G.E.		400/1200
15	G.E.	1026	800/3700

MOTOR GENERATOR SETS

1—30 KW. Gen. Elec. Generator Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440/60/720 RPM, with panel board.

1—10 K.W. Gen. Elec. Generator Type ML, 125 v. direct connected to 15 HP Lincoln motor, 3/60/440/1200 RPM, with panel board.

AIR COMPRESSOR

1—1000 CFM, 125 lb. pressure Worthington feather valve, 2-stage compressor. Immediate delivery.

2—5000 CFM, Worthington 45# low pressure. Complete with 500 HP. Gen. Elect. Synchronous motors, 3 Ph. 25 Cy. 2300 Volts.

PRIMARY CONTROLS

2—200 Amp. Conrad-Schweitzer 3 Pole Fused Load Breaks, 2300 V.

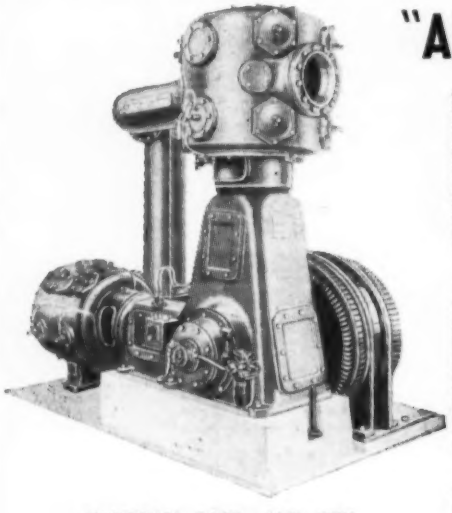
2—150 HP. Westinghouse oil type magnetic contactors, 3/60/2300 V.

1—225 HP. Square D. oil type magnetic contactor, 3/60/2300 V.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

"AIR COMPRESSORS — FROM STOCK"



INGERSOLL RAND—2020 CFM

(Illustrated)

Type: XV HE-2 No. 10640 Size: 26" & 15½" x 13" Speed 300 rpm Arr'g't: Right angle compound 2 stage intercooled & aftercooled. Displacement: 2387 c.f.m. Delivery: 2020 c.f.m. Drive: Direct connected English Electric Synchronous motor Form SMW No. 75525, 375 H.P. 2200/3/60 current. Controls: Push button operated full voltage full magnetic controller with overload and under voltage protection. Full switchboard and interconnected wiring. Separately driven exciter and drive motor with starter for 440/3/60 current. Auxiliaries: Intercooler, aftercooler, air filter assembly, circulating pump, unloader, five step control, spares, wrenches, fittings and some interconnected piping. Receiver if required.

LARDLAW DUNN GORDON—2500 CFM

Type: High & low No. 23467 Size: 30½" & 18⅛" x 30" Speed 120 rpm Arr'g't.: Horizontal compound 2 stage intercooled. Displacement: 3050 CFM. Delivery 2500 C.F.F. Drive: Direct connected Westinghouse synchronous motor No. 38233 mounted between stages. 500 H.P. 2300/3/60. Controls: Synchronous motor controller, switchboard and interconnected wiring. Separately driven exciter and motor with starter for 440/3/60 current. Auxiliaries: Unloader, intercooler air filter assembly circulating pump, fittings and some interconnected piping. Receiver if required.

BURY—800 CFM

Class CCB No. 851 Horizontal compound two stage intercooled. Displacement: 925 CFM. Delivery: 800 CFM. Speed 150 rpm. Drive: Belt driven from General Electric synchronous motor Type ATI No. 123150. 225 KVA 2200/3/60 current. Controls: Synchronous motor controller, switchboard, direct connected exciter. Auxiliaries: Intercooler, Unloader, Belt, Pulleys, Belt tightener, gauges, oilers.

INGERSOLL RAND—475 CFM

Horizontal compound two stage intercooled. Displacement: 600 CFM. Delivery 475 CFM. Speed 185 rpm. Drive: Belt driven motor optional—to customers specification. Auxiliaries: Intercooler, Unloader, fabricated base.

HOLMAN—500 CFM

Type T two stage intercooled. Displacement: 612 CFM. Delivery 500 CFM. Speed 720 RPM. Drive: Petters cold starting two cylinder 112 H.P. Diesel Engine and flat belt drive. Auxiliaries: Intercooler, unloader, belt, pulleys, air receiver and cooling tanks for engines.

INGERSOLL RAND—265 CFM

Type V2 No. 58341 tandem compound two stage intercooled combined Diesel compressor. Displacement: 354 CFM Delivery 265 CFM. Speed 330 rpm. Drive: Driven from single cylinder oil engine as integral part of compressor unit. Vertical mounted air cylinders in tandem and horizontally mounted engine cylinder employ single crankshaft. Auxiliaries: Regulator, intercooler, safety valve, gauges.

CANADIAN RAND—150 CFM

No. 5731 horizontal water cooled single stage single cylinder. Size: 10x12. Displacement: 240 CFM. Delivery: 150 CFM. Speed 220 rpm. Drive: Adaptable to belt or direct drive.

AIR RECEIVERS

No. on hand	Diam.	Length.	Working Press.
1	6'— 6"	18'—0"	125 p.s.i.
1	3'— 0"	6'—4"	300 p.s.i.
2	1'— 8"	5'—0"	100 p.s.i.
1	1'—10"	4'—0"	170 p.s.i.

General Machinery LTD

GRANVILLE ISLAND, VANCOUVER, B.C. Tel. PAcific 3487

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

1—4000 KW General Electric Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
2—3125 KVA General Electric Extrac.
1—2500 KVA General Electric Cond.
1—1875 KVA Westinghouse Cond.
1—1875 KVA Westinghouse Non-C.
1—1563 KVA Westinghouse Extrac.
2—1250 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 225 KVA General Electric Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Ames Uniflow
1—150 KVA Harrisburg 4-valve

D. C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—150 KW Ridgway 4-valve, 125/250.V.

DIESEL ENGINE UNITS

2—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 250 V. 60 cy. gen.
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
1— 300 HP McInt. & Sey., 480 V. 60 cy. gen.
2— 250 HP Gen. Motors, 460 V. 60 cy. gen.
1— 150 HP Buckeye 400 RPM eng. only
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.
4— 15 KW Int. Har. UD-6, 3-60-127/220 V.

WATER TUBE BOILERS

2—1409 HP B. & W. 650-lb., Stokers
2— 560 HP Erie City 460-lb.
1— 519 HP Titusville 200-lb., Stoker
5— 492 HP Heine 180-lb., Stokers
2— 469 HP B. & W. 425-lb., Pulverizer
2— 323 HP Springfield 225-lb., Stokers

SYNCHRONOUS MOTORS

1—400 HP Al. Ch. 60 cy. 2300 V. 514 RPM
1—300 HP G. E. 60 cy. 2200 V. 600 RPM 3-bearing
1—300 HP West. 60 cy. 2300 V. 900 RPM
1—200 HP West. 60 cy. 2300 V. 900 RPM
1—100 HP G. E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

3—6000 HP G. E. 2300 V. 90 RPM
1—1000 HP West. slip ring 2200 V. 360 RPM
1— 800 HP G. E. sl. rg. 2200 V. 450 RPM
1— 500 HP G. E. sl. rg. 2200 V. 3600 RPM
2— 200 HP West. sq. cage 220/440 V. 900 RPM
2— 120 HP G. E. sq. cage 220 V. 3600 RPM

MOTOR GEN. SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1—1000KW Gen. Elec. 600 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chal. 275 V. DC, 25 cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chal. 275 V. DC, 25 cy.
1— 75 KW Westinghouse 125 V. DC, 60 cy.
1— 50 KW Westinghouse 250 V. DC, 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—2000 KW General Electric 600 V.
2—1500 KW Westinghouse 250 V.
1—1000 KW Allis Chalmers 600 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.
4— 500 KW Westinghouse 275 V.

FREQUENCY CHANGERS

1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
1—1250 KVA West. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1—1000 KVA Al. Ch. 25/62½ cy. 375 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

4— 6667 KVA G. E. 79660/138,000-34500 V.
2— 2000 KVA West. 69/34.5-4.8/2.4 KV
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
4— 333 KVA Al. Ch. 25410/44000-13200/23000Y V.
3— 150 KVA G. E. 33000-11000 V.
1—10000 KVA West. 264-4580 V. 3 ph.
1— 6000 KVA West. 264000-2300 V. 3 ph.
3— 1500 KVA G. E. 22500-550 V. 1 ph. 25 cy.
3— 1000 KVA West. 26400-4150 V.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
2—10000 KVA Pitts. 13200-4600 V. 3 ph.
1— 1250 KVA G. E. 13800/27600-2300 V. 3 ph.
2— 1000 KVA G. E. 11500/23000-575 V.
3— 400 KVA G. E. 11500-2300 V. 1 ph.
2— 1500 KVA West. 4000-2300 V. 3 ph.
1— 300 KVA West. 450-100 V.

OIL CIRCUIT BREAKERS

2— 400 A. 25 KV G. E. FK0136	Outdoor
2—1000 A. 23 KV Kelman CB76	Outdoor
4— 600 A. KV G. E. FHK0139-24BS	Outdoor
1— 600 A. 15 KV G. E. FK037	Pole type
1— 600 A. 15 KV West. 0-221	Outdoor
2— 400 A. 15 KV G. E. FHK0136	Outdoor

PARTIAL LIST — WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

HEAVY DUTY DIESELS

720 HP Fairbanks Morse model 33, 5 cyl. 580 KVA 2300 volt F-M Generator. Late type. Complete.

560 HP Fairbanks Morse model 33, 4 cyl. 470 KVA 2300 volt F-M Generator. Late type. All accessories.

380 HP McIntosh Seymour 4 cycle, 3 cyl. 200 KW G-E 2300 volt Generator.

Perfect shape. Very low priced.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

FOR SALE
3—1000 G.P.M. 2—750 G.P.M.

FIRE PUMPS STEAM DRIVEN

6000 G.P.M. 33' Hd. Cent. Pump
850 C.F.M. 100 lb. duplex Compressor
7"x8" & 8"x10" Triplex Pumps
1000 G.P.M. Diesel Brass Cent. Pumps
30 H.P. Buffalo size 7E Blowers
6000 lb. Press. 28 C.F.M. Compressor
2—6" Blackmer Rotary Pumps
#60 Double ball bear. Paddle Blower
100 H.P. Buda Diesel Engines

SUPERIOR EQUIPMENT CO.
138 Grand St. N. Y. C.

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—10000 KW. 11000 V. Cond.
2— 3000 KW. 600 V. Cond.
1— 2500 KW. 2300 V. Cond.
1— 2000 KW. 600 V. Cond.
1— 1250 KW. 2300 V. Cond.
1— 1000 KW. 2300 V. Cond.
1— 625 KW. 2300 V. Cond.
3— 500 KW. 2300 V. Cond.
1— 500 KW. 240 V. Cond.
2— 100 KW. 115 V. D. C.

ENGINE GENERATORS

2—600 KW. 2300 V. Uniflow
1—400 KW. 440 V.
1—168 KW. 600 V.
1—250 KW. 480 V.
1—150 KW. 480 V.
1—125 KW. 125/250 V. D. C. Uniflow

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#
5— 56 H.P. 1600 RPM, new

BOILERS

1—1390 H.P. 400# Coal
1— 990 H.P. 200# Coal
1— 750 H.P. 150# O.I.
2— 507 H.P. 180# Coal
1— 360 H.P. 190# Coal
2— 100 H.P. 100# Oil
1— 200 H.P. HRT 160#

AIR COMPRESSORS

1—6000 CFM 50# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1—1700 CFM 100# Steam
1— 600 CFM 350# Steam
1—5000 CFH 600# Belted
1—1000 CFH 3000# Belted

PUMPS

1—Vacuum, Size 14"x22"24" Steam Driven
1—3000 GPM 65' Head, Motor Driven
1—600 GPM 162' Head Motor Driven

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The buyer Must Be Satisfied—Always

MOTORS—M. G. SETS—CONTROL

In Stock—Immediate Shipment—Rebuilt & Guaranteed

230-VDC CRANE & MILL MOTORS

	H.P.	Make	Type	R.P.M.
(1)	1	P. & H.	5½ x 3½	850
(2)	2¼	Westg.	K-1	835
(6)	3½	G.E.	C.O.-1803	700
(1)	3¼	Westg.	K-2	825
(4)	5	G.E.	MD-101	825/975
(1)	6	G.E.	C.O.-1805	1150
(1)	9	G.E.	M.D.-102 (back axle) (C.P.)	975
(1)	10	G.E.	C.O.-1805	925
(1)	10	G.E.	C.O.-2504	700
(3)	14/19	C.W.	B.W. (back axle)	675/560
(2)	14/19	C.W.	B.W.	675/560
(1)	13	G.E.	MD-103 (B.X.)	800
(1)	19	C.W.	SWS-15	560
(1)	20	Westg.	HK-6	650
(1)	21	G.E.	Type 52	345
(1)	25	G.E.	COM-1828 (C.P.)	850
(1)	25	Westg.	K-8	575
(1)	29	Westg.	K-7	630
(1)	30/42	C.W.	D.W.	620/520
(1)	30/45	G.E.	MD-104½ (C.P.)	625/500
(1)	33	C.W.	SWS-25	500
(3)	35	G.E.	CO-2506	650
(1)	50	G.E.	MD-105 (C.P. B.X.)	550
(2)	50	G.E.	COM-1830 (C.P.)	525
(1)	52	Westg.	K-10	740
(1)	52/80	C.W.	F.W.	575/480
(1)	60	Westg.	MTA-No. 2 (Back Axle)	

(All above series wound except where C.P. compound wound.) (B.X. back axle.)

230-VDC (Variable Speed)

H.P.	Make	Type	Winding	R.P.M.
(1) 3/4	G.E.	B.D.-225	SH.	600/1800
(1) 2	G.E.	R.C.-4-2	CPD.	600/1000
(1) 3	G.E.	RLC-111	SH.	500/1500
(1) 3	G.E.	CR-3	SH.	500/1500
(1) 3	Reliance	T-14	SH.	1200/3600
(1) 4	G.E.	R.C.-5-4	CPD.	600/1000
(1) 5	G.E.	RLC-115	SH.	250/1000
(1) 5	G.E.	RF-9	SH.	450/1350
(1) 5	Westg.	SK-33	SH.	1150/1650
(1) 6	G.E.	RF-9	SH.	450/1350
(1) 6/10	G.E.	RLC-114	SH.	500/1500
(1) 7½	G.E.	RF-10A	SH.	450/1350
(1) 7½	Westg.	S-K70	CPD.	450/1800
(1) 7½	Westg.	SK-70	SH.	600/1800
(1) 7½	Westg.	SK-60L	CPD.	650/1000
(1) 8	Westg.	SK-100L	SK.	300/1200
(1) 8½	G.E.	RF-9	SH.	600/1800
(2) 9	G.E.	RF-10	SH.	400/1600
(1) 10	El. Dy.	7½ S (115-Volt)		250/1000
(1) 10	Westg.	SK	SH.	250/1000
(1) 10	G.E.	RF-12	SH.	300/1200
(3) 10	Westg.	SK-90	SH.	400/1600
(1) 15	El. Dy.	10-S	SH.	450/1350
(1) 15	G.E.	RF-11	SH.	400/1600
(1) 15	G.E.	RF-10	SH.	550/1650
(1) 10/15	Al. Chal.	EB-100	SH.	575/1725
(1) 15	El. Dy.	5-S	SH.	600/1200
(1) 19	Westg.	SK-100L	SH.	600/1200
(1) 20	G.E.	RF-12	SH.	400/1200
(1) 20	G.E.	RF-12	SH.	400/1600
(1) 25	G.E.	RF-13	SH.	400/1200
(1) 25	G.E.	CD	SH.	200/1800
(1) 35½	Westg.	SK	SH.	400/1200
(1) 35/50	Westg.	SK-160	SH.	500/ 750
(1) 50	Westg.	SK	SH.	250/1000
(1) 60	Westg.	SK-131	SH.	500/1500

(5)—100-HP. Reliance Motors, 230-VDC., Shunt, Frame 1050-T, cont. duty, 400/1200-RPM.
(1)—150/185-HP. Electro Dynamic Motor, 230-VDC., Frame 75-S. cont. duty, comp. interpole, 250/500-RPM., with Monitor Control Panel, non-rev., 4-step acceleration, resistance built into back of panel all protected.
(1)—200/250-HP. Reliance Motor, Frame T-2600, comp. interpole, cont. duty, 230-VDC., 400/800-RPM., complete with control.

(1) 25	G.E.	RF-13	SH.	250/1000
(1) 35	G.E.	RF-14	SH.	250/1000

Can supply these (3) Motors with G.E. Type Cr-2251 Planer Control Complete with Rheostats and Resistance for Shunt Field and Armature Regulation.

SQUIRREL CAGE MOTORS
220/440-V., 3-PH., 60-CY.

H.P.	Make	Type	R.P.M.
(1) 1¼	G.E.	KT-180	600/1800
(1) 3¼	G.E.	KT-201	600/1800
(1) 20	G.E.	I-K	565
(1) 20	Al. Chal.		1130
(1) 25	G.E.	KT-322	1170
(1) 25/12½	Westg.	CS-404	1730/880
(1) 60	G.E.	FT-5274	3600
(1) 60	Westg.	CS-752-C	690
(2) 60	C.W.	Q-25	430
(1) 75	Westg.	CS-754-C	690
(5) 75	C.W.	Q-23	690

SLIP RING MOTORS CONST. DUTY
3-Ph—60-Cy.

H.P.	Volts	Make	Type	R.P.M
(1) 3	220 (2-PH)	G.E.	MQ-1801	1080
(1) 10	220 (2-PH)	G.E.	IQ	1120
(1) 20	220	G.E.	MT-326	850
(2) 25	2200	G.E.	MT-332	850
(2) 25	550	G.E.	MT-332	850
(1) 30	440	Al. Chal.		860
(1) 38	220/440	G.E.	I-M	1200
(1) 40	2200	Al. Chal.		435
(1) 40	550	Al. Chal.		435
(3) 40	600 (40-CY.)	G.E.	I-M	1170
(1) 50	440	G.E.	MT-353	900
(1) 125	2200	Wagner	BR	1160
(1) 150	550	G.E.	I-M	840
(1) 200	2200	G.E.	I-M	580
(1) 250	2200	Westg.	CW-1314	277
(1) 250	2200	G.E.	I-M	585
(1) 250	550	G.E.	I-M	585
(1) 300	2200	Al. Chal.		505

PLATING GENERATOR SET

(1)—Factory Built, General Electric, 3-unit set, (2)—70-K.W. 50-volt, 3000 amp. generator driven by a 210-HP., Westinghouse SYN. Motor, 440/3/60-cy., 514-RPM., with separate motor driven exciter, complete with all control panels, rheostats, motor control, etc.

T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

. . . INSPECTED & GUARANTEED CERTIFIED READY FOR USE

A. C. Motors, 3 phase, 60 cycle

Qu.	H.P.	Make	Type	Volts	Speed
7	½	Gen. Elec.	K	110	1800
3	1½	Cr. Wh.	SC-224B.B.	220/440	1800
3	3	West., new	CS-254B.B.	220/440	1200
10	5	Gen. Elec.	K-225	220/440	3600
5	5	Gen. Elec.	K-254	220/440	1800
2	10	West.	CS	220/440	1200
3	15	Wagner	RPI-326	220/440	1800
1	15	Gen. Elec.	KT-522	220/440	720
2	20	West.	CS	220/440	1200
1	20	Gen. Elec.	KT-526	220/440	720
1	20	West. sl. rg.	CW	220/440	720
1	25	Cr. Wh. sl. rp.	open	220/440	1200
1	100	Gen. Elec.	KT-347	220/440	1800
1	27	Otis sl. rg.		220/440	600
1	800	G.E. sl. rg.		2200	443
1	25	Al. Ch.	IK	220/440	700
1	300	West. sl. rg.	CW	220/440	1200
1	25	Lincoln		220/440	1200
1	30	Gen. Elec.	KT	220/440	600
2	30	Al. Ch.	AR-220	220/440	900
2	30	Gen. Elec.	KT	220/440	900
1	400	Al. Ch. sl. rg.		2200	1800
1	30	West. Elec.	KT	220/440	900
1	100	Al. Ch.		220/440	900
1	60	Sprague s.rg.	IQ	220/440	720
1	75	Cr. Wh.	SC	220/440	1800

A .C. Motors, 3 phase, 60 cycle

2	¼	West.	C	220/440	750
5	⅝	Gen. Elec.	KT-181	220/440	750
5	7½	G.E. sl. rg.	MT	220/440	750
3	10	G. E. sl. rg.	I	220/440	750
2	10	West.	CS	220/440	500
3	15	Gen. Elec.	I	220/440	750
1	15	Howell b. b.	SCR	220/440	500
1	20	Wagner	BP	220/440	750
1	20	West. sl. rg.	CW	220/440	750
1	25	Burke sl. rg.		220/440	750
1	25	Gen. Elec.	IK	220/440	750
2	40	Gen. Elec.	KT-533S	550	1500
1	65	Gen. Elec.	IM	220/440	1500

A. C. Motors, 3 phase, 25 cycle

Qu.	H.P.	Make	Type	Volts	Speed
1	30	Howell b. b.	SCR	220/440	1200
3	30	Gen. Elec.	I	220/440	1800
2	250	Gen. Elec.	I	220/440	1500
1	200	West.	CS	220/440	750
1	200	Gen. Elec.	IK	220/440	750
1	150	Gen. Elec.	IK	2200	500
1	40	Burke syn.	AC-8	220/440	750
1	75	Gen. Elec.	IK	220/440	1500
1	75	West.	CS	220/440	750
1	100	Cr. Wh.	T.E.F.C.B.B.	220/440	1500
1	100	West.	CCL	220/440	1500
1	225	G.E. sl. rg.	ITC	220/440	500
1	1000	Gen. Elec.	I sl. rg.	2200	300
1	900	West. syn.		2200	185

1—600 H.P. Chalmers Slip Ring, 3 ph. 25 cy., 2300 V. 295/300 RPM, Type ANY, Rolling mill duty, 3 brg, complete.

WELDERS
12—400 ampere Lincoln Welders, 3 phase, 60 cycle, 220-440 volts.
3—300 ampere Lincoln Gas Welders driven by 6 cycle Hercules engine.

FREQUENCY CHANGERS
1—120 K.V.A. Frequency Changer 25 to 60 cycle.
1—600 KW Frequency Changer 25 to 62½ cycle.

AIR COMPRESSORS
2—Ingersoll Rand Air Compressors, Imperial type XCB, 20 x 12½ x 16, 1200 C.F.M., 100 lbs. pressure, Belt drive by 200 H.P., 3/25/2300 volt motors, complete with starters.

TRANSFORMERS
2—100 K.V.A. Packard, 60 cycle, 4600/230/460.
1—10,000 K.V.A. Pittsburg 13,200 volt primary 4,600 volt secondary, 3/60 Delta, Delta connected.
1—250 K.V.A., GE 3/25, 2300/460 volts.

M. G. Sets
2—200 KW Allis Chalmers 125 V DC 25 or 60 cy. dr.
1—75 KW, 125 volt D.C. motor driven 115 H.P., 3/25/2200/750 with A.C. & D.C. Panel.
1—30 KW, General Electric 250 volt DC mounted on Factory base, driven by 50 H.P., General Electric, 25 cycle motor.
1—100 KW, Westinghouse, 250/125 volt D.C., 25 cycle drive.

1—3 Ton Electric Furnace, complete with transfs, panels and ladels, 25 cy.

1—General Electric, Rotary Convertor, synchronous Booster type, KW 700 complete throughout.

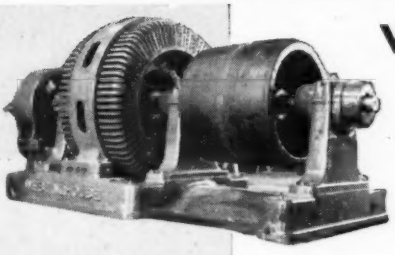
D. C. Motors
1—125 H.P., General Electric, 230 volt, 1800 R.P.M.
1—1 H.P., Century, 230 volt, 1800 R.P.M.
5—2 H.P., General Electric, 230 volt, 1700 R.P.M.
1—2 H.P., Century, 230 volt, 1200 R.P.M.

Volland ELECTRIC EQUIPMENT Company Incorporated

1511 NIAGARA ST. Phone Grant 2715 BUFFALO 13, N. Y.

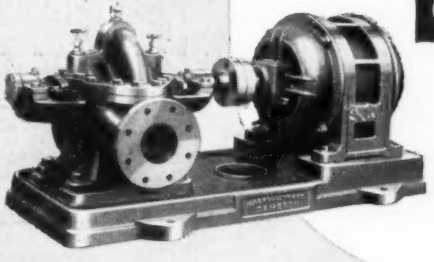
get PUSH! behind production

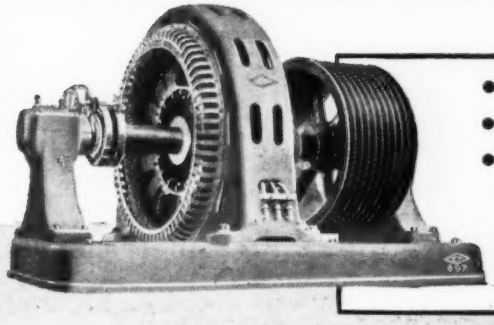
with *Rebuilt* POWER EQUIPMENT



Whether you need a single motor —or a complete power plant installation, you'll find the ideal answer to your equipment problems at Chicago Electric Company. Boasting the nation's largest and most complete stock of rebuilt equipment Chicago Electric is prepared to furnish any size unit—for any size job. You can save time, trouble and money by specifying *Chicago Electric Rebuilts* . . . They're guaranteed *same as new.*

CHICAGO ELECTRIC CO., 1318 W. 22nd St., Chicago 8, Ill.





- REBUILDING
- REPAIRING
- REWINDING
- BUYING
- SELLING
- RENTAL

REBUILT POWER EQUIPMENT

READY TO SHIP!

ALTERNATING CURRENT MOTORS

3 ph., 60 cy.

H.P.	Make	Volts	R.P.M.	Type
1	Wagner	220	1140	Sq. Cage
2.25	Northwestern	440	1080	HEW 1½ Slprg
5	Westg.	220 or 440	850	CS–Sq. Cg.
7½	Westg.	220	1200	CS–Sq. Cg.
7½	Lincoln	220	900	Sq. Cg.
20	G. E.	220	1750	302–Sq. Cg.
22	G. E.	220	1200	Sq. Cg.
25	Westg	220	570	Sq. Cg.
30	Westg.	220	490	Sq. Cg.
50	Westg.	220 or 440	580	CW–Slprg.
100	Cr. Wh.	200	700	Slipring
100	Fynn Weischel	220/440	900	31V-RN Sq. Cg.
200	Allis Chal.	2200	505	Slipring
300	G. E.	2200	600	CW Slipring
300	G. E.	2200	585	I Slipring
400	Westg.	2200	435	CW Slipring

COMPRESSORS

2—315 cu. ft. 100# pres. Ingersoll Rand Models 315 and 315A Portable Air Compressors with 105 HP. Waukesha Oil Engines complete with accessories.

1—610 cu. ft. 100# pressure Burry Horiz. Compressor.

VARIABLE SPEED MOTORS

230 VOLT D. C.

H.P.	Make	R.P.M.	Type
40	Westg.	600/1200	SK
20	Westg.	400/1600	SK
15	Westg.	700/1600	SA
10/15	Electro Dy.	600/1200	
10	Westg.	800/1600	SA
10	Cr. Wh.	690/895	CMC
10	J. C. Curran	950/1230	
10	Westg.	400/1600	SA
10	Sprague	625/1250	LC
7½	G. E.	450/1350	RF
4	G. E.	850/1700	LC-8
3	Roth	500/1000	RS

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
175	G. E.	230	475	MD
50	North.rn	220	600	K
35	Westg.	230	550	49D
32	Shaw	230	485	5L2F
15	Westg.	220	650	RL
15	Cr. Wh.	220	270	SM
10	Westg.	230	750	MT-00
7½	Westg.	230	975	S
3½	Westg.	230	1200	L

230 VOLT DC MOTORS

H.P.	Make	R.P.M.	Type
1/6	Bodine	3400	
¼	Triumph	525	14-F
1½	Master	3450	DM
1.5	Louis Allis	1750	NA
2	Westg.	1180	CD
3	Western Elec.	1125	E-20-R
3½	Westg.	975	S
4	G. E.	850	LC-8
5	Westg.	1150	SK
7½	G. E.	1700	RC
8	G. E.	950	RC-11
10	Cr. Wh.	850	CM
12	Northern	1475	
15	Allis Chal.	800	
20	Westg.	600	M
20	Westg.	975	S-6
25	G. F.	650	MD
25	Westg.	825	SK113
35	G.E.	700	DLC

MOTOR GENERATOR SETS— 250 & 500 V. D. C.

1—125 KW. 250 v. Ridgway Generator 900 rpm. direct connected to a 225 HP. 2200 v. 3 ph. 60 cy. Ridgway synchronous motor.

1—100 KW. 900 rpm. 550 v. Westg. Generator coupled to a Westg. 2300 v. 3 ph. 60 cy. synchronous motor.

1—65 KW. 125 v. DC General Electric Generator dir. driven by a 100 HP. 1200 rpm. 2200 v. AC Motor.

1—50 KW. 750 rpm. 115/230 v. DC type SK Westg. Generator coupled to a 75 HP. 220/440 v. 3 ph. 60 cy. motor.

1—25 KW. 1800 rpm. 120 v. 208 amp. single ph. 60 cy. AC Generator with a 20 HP. type MG 115 v. DC Motor.

1—15 KW. 1150 rpm. 115/230 v. DC Westg. type SR Generator direct driven by 20 HP. 220 v. 3 ph., 60 cy. type CS motor.

1—3 KW. 1350 rpm. 250 v. type 8 Westg. Gen. dir. conn. by coupling to HP 1350 rpm. 110 v. Westg. Mtr.

INDUSTRIAL TRUCKS

5—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.

6—New 4 ton Yale & Towne model Y8W Multi-Stroke Hand Lift Platform Trucks.

PUMPS

1— 130 gpm. 50 ft. head Dayton Dowd Pump.
1— 378 gpm. 44 ft. head Dayton Dowd Pump.
1— 400 gpm. 75 ft. head Allis Chalmers Pump.
1— 600 gpm. 32 ft. head Dayton Dowd Pump.
1— 750 gpm. 20 ft. head Dayton Dowd Pump.
1— 750 gpm. 70 ft. head Dayton Dowd Pump.
1—1200 gpm. 110 ft. head Allis Chalmers Pump.
1—1500 gpm. 90 ft. head Allis Chalmers Pump.
1—3500 gpm. 90 ft. head DeLaval Pump.
1—4000 gpm. 138 ft. head Ingersoll-Rand Pump.
1—4200 gpm. 250 ft. head Ingersoll-Rand Pump.
1—5000 gpm. 100 ft. head American Marsh Pump.
1—5600 gpm. 143 ft. head Alberger Pump.
1—8000 gpm. 100 ft. head American Well Works Pump.

WRITE, WIRE OR PHONE YOUR ELECTRICAL NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

SLIP RING MOTORS

3-PH., 60 Cy.

HP	Volts	Make	Speed
900	2300	G.E.	900
600	2200	G.E.	720
500	2300	G.E.	900
300	440	Al. Chal.	900
250	2300	G.E.	600
350	440/550	G.E.	600
200	2200/440	G.E.	600
150	2200	G.E.	450
150	2200/440	G.E.	600
150	440/220	G.E.	1200
125	440/220	Whse.	1200
125	440/220	G.E.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E. MTC	900
100	440/220	Whse.	1200
100	440/220	G.E.	1200
80	440/220	G.E. (MTC)	900
75	2200	Al. Chal. (new)	900
75	440/220	G.E. (MTC)	600
75	2200/440	G.E.	1200
50	2200/440	G.E.	600
75	550	G.E.	900
40	2200	Whse.	900

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-132 General Electric, 3PST, 25,000 Volt Oil Switch, interrupting Capacity 125,000 KVA, complete CT's PT's, etc.

1—New 25500 amp., DA 75, Whse., 3 pole, air type circuit breaker

SYNCHRONOUS MOTORS

3-PH., 60 Cy.

500	440/220 v.,	G.E.	TS	900
475	4000/2300 v.	Cr. Wh.		900
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN	900
300	2200	Whse.	G	720
300	440/220	Al. Ch.		600
250	4000/2300	G.E.	TS	1200
240	2200	G.E.	ATI	600
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
110	440/220	G.E.	TS	1800
100	440/220 25 cy.	G.E.	TS	375

A. C. GENERATORS

1—450 kva., 900 rpm., 440/220 v., GE.
1—450 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 600 rpm., 440/220 v., G.E.
1—225 kva., 600 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
1— 36 kva., 360 rpm., 480/240 v., G.E.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G	K	1200
500	440/220	G.E.	IK	900
400	2200/440	Whse.	CS	720
400	2220/440	G.E.		600
400	550	G.E.	IK	720
350	440	G.E.	IK	900
200	440/220	Whse.		1200
220	2200	G.E.		1800
200	440/220	Wagner	RP	1800
200	2200/550	Al. Ch.	AR	900
150	2200/550	Al. Ch.	AR	1800
150(3)	440/220	G.E.	KT	1200
125	2200	G.E.	KT	600
100	440	G.E.	IK	450
100	2200	G.E.	KT	1800
100	440	Whse.	CS	1200
74	2200	G.E.	KT	900
50	2200	Al. Ch.		720

MOTOR GENERATOR SETS

1—150 kw., 250 v., 1200 rpm., GE, conn. to 225 hp. 2300/440 v., 60 cy., synchronous motor.
1—100 kw., 250 v., 900 rpm. Whse., conn. to 150 hp. 2300 v., 60 cy., sq. cage motor.
1—60 kw., 250 v., 1200 rpm. G. E., conn. to 90 hp. 440/200 v., 60 cy., syn. motor.
1—60 kw. 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—35 kw., 120 v., 1800 rpm. G.E., conn. to 50 hp. 440/220 v., 60 cy., squirrel cage.

TRANSFORMERS

60 Cycle

3—333 kva., Whse., 13200-2400 v.
2—333 kva., Moloney, 13800/6900-230/460 v.
1—300 kva., Whse., 3 Ph., 13800-230 V.
3—250 kva., Whse., 13,800-460.
3—200 kva., Ptsb., 13200/6600-460 v.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950V-230.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

POWER EQUIPMENT

1—2250 KVA, 3 phase, 60 cy., 3600 RPM, Gen. Elec. Turbo Generator, steam pressure 410 lbs. 275° S.H. 725° T.T. with surface condensor.
1—625 KVA, 3 ph., 60 cy., 480 vlt., 900 RPM, Westgh. Generator to a Westgh. non-condensing turbine.
265 new Gen. Elec. transformers 3 to 75 KVA, 450 to 117 vlts.
68 new Gen. Elec. transformers 3300-6600-11000 to 120-240 vlts type HSBA.
1—150 K. W. 125 volts 400 RPM Crocker-Wheeler compd wound interpole Generator to a 4 cylinder, vertical unaflow Ames engine.
1—360 HP Anderson full diesel, Model 29 257 RPM with clutch and pulley on one end to drive an ice machine or any other machine and a 125 KVA, 3 phase, 60 cycle, 240 volt Generator direct connected on opposite end.
1—90 KVA, 3 ph., 60 cy., 2300 V, Fairbanks Morse Generator connected to a 2 cylinder Fairbanks Morse full diesel type Y, style VA.
1—156 KVA., 3 ph., 60 cy., 240 volt, 1200 RPM, type ATB frame 9635 General Electric connected to an 8 cylinder Buffalo Gasoline engine.
1—1000 K.W. 3 ph., 60 cy., 480 volt, 3600 RPM, General Electric Generator to a General Electric turbine 180 lbs steam pressure 40 lbs back pressure.
1—300 KW, 3 ph., 60 cy., 440 vlt. 3600 RPM Westinghouse Generator only.
7—500 amp. 6 V direct current to 3 ph., 60 cy., 220 vlt. General Electric rectifiers.
1—750 KW Gen. Elec. Extraction type Turbine 3 ph., 60 cy., 600 vlt. 150-175 lbs., 10 to 20 lbs. extraction.
1—100 KW, 125 V, type CD1247 General Electric to a 150 HP 3 ph., 60 cy., 220 vlt. type K5572 Gen. Elec. induction motor.
1—50 KW, 250 volt Gen. Elec. to a 75 HP 3 phase, 60 cycle, 440 Vlt. General Electric motor.
A large number of new 115 volt direct current ball bearing General Electric motors 5 to 20 HP.
1—1500 KW, 250 vlt., 600 RPM Westinghouse rotary converter complete with transformers and switchboard.

Send us your inquiries, our stock is continually changing

KEYSTONE
Power Plant Equipment Company

8403 Hegerman St. Phila. 36, Penna.

SYNCH. CONVERTERS

500 KW G. E. 250 D.C. 2300/4000 A.C. 1200 RPM, 6 PH, 60 CY. COMPLETE SWITCHGEAR.
300 KW G. E. 600 D.C. 2300/4000 A.C., 1200 RPM, 6 PH, 60 CY. COMPLETE SWITCHGEAR.

MOTOR GENERATORS

150 KW G.E. SYN. 250 V. 2300 A.C. 900 RPM, 3 PH. 60 CY. COMPLETE SWITCHGEAR.
150 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM, 3 PH. 60 CY. COMPLETE SWITCHGEAR.
60 KW C. W. IND. 230 V. 220/440 A.C. 1160 RPM. 3 PH. 60 CY. COMPLETE SWITCHGEAR.

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK COMPANY

Incorporated

502 Grant Building, Pittsburgh, Pa.

BOILERS

with Pulverizing Plant
total 1000 HP. 200#, complete
1—400 HP. 350#, 1—400 HP. 425#
2—400 HP. 250#, 2—450 HP. 425#

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., New York 33, N. Y.

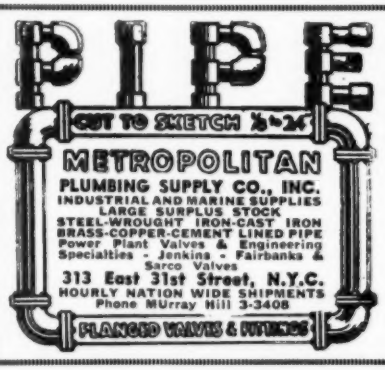
COMPRESSORS
Vacuum Pumps

New & Guaranteed Rebuilts
Stationary & Portable

SALE OR RENT

Worthington Authorized Distributors

AMERICAN AIR COMPRESSOR CORP.
4784 Dell Ave.—N. Bergen, N. J.
N. Y. Phone Ch 4-7665, N. J. Phone Union 5-4848



BOILERS

10 to 1000 H.P.
NEW-USED
RECONDITIONED
Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

Write—Wire—Phone us if you don't see the item you need. This listing is only a part of our large stock.

M-G SETS

225 KW G.E. MPC gen. DC 125 V. coupled to 350 HP Whse. synch. motor 3/60/440 V. 900 RPM.
150 KW Gen. Elec. type MPC gen. DC 125 V. coupled to 225 HP sq. cage motor 3/60/2200 V. 1200 RPM.
150 KW G.E. MPC gen. DC 250 V. coupled to 225 HP sq. cage motor 3/60/440 V.
60 KW G.E. C.D. gen. DC 60 V. 1000 amp. coupled to 90 HP synch. motor 3/60/220/440 V.
37½ KVA Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. SK motor DC 230 V. 1150 RPM. 3 brg.
Others available—special units built to order.

D. C. MOTORS

H.P.	Mfg.	Type	Volts	Speed
125	Cr. Wheeler	125H	230	500
75	Whse.	S136	125	475
75	Whse.	SK	230	850
65	G.E. Northern	C	230	375/750
60	Diehl dynamon.	R10	250	500/2000
50	G.E. Sprague	LC	250	700
50	Cr. Wheeler (5)	50H	230	700
40	Roth	S	115	850
40	Whse.	SK	230	1750
35/50	Gen. Elec.	CD123	230	575/1150
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
25	G.E. b. b. New	CD93	115	1150
20	G.E. b. b. TEFC New	CD95	230	1200
20	G.E. b. b. New(2)	CD83	115	1750
20	Reliance	T	230	850
20	Imperial Int. dty.	D37	230	1200
20	Gen. Elec.	LC	230	575
20	Gen. Elec.	DLC	230	500/1500

SPECIAL—3—Oil Gear Co. Pumps, 1100 lbs. 104 gpm., on steel base—BARGAIN.

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfg.	Type	Speed
1	400	Gen. Elec. 3 brg.	I-P	450
1	400	Allis Ch. 2200 v.	AFY	1800
1	300	Whse.	HF	400
1	300	Burke	EMV	225
1	200	G.E. 2200 v.	I-M	360
1	200	Whse. 3 brg.	HF	600
1	75	Gen. Elec.	I-M	514
1	75	G.E. 2200 v.	I-M	1800
1	75	F. Morse 2200 v.	BV	1800
1	50	Whse.	NW332	900
1	50	Gen. Elec.	I-M	600
1	50	G.E. 2 phase	I-M	900
1	50	F. Morse b.b.	HV	1200
1	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	40	G.E. 550 v.	MT536	900
1	37	G.E. int. duty	ITC	600
3	35	Lancashire b.b.	late	1800
1	35	Whse. int. duty	CW	900
2	30	Allis Ch.	ANY	900
1	30	Gen. Elec.	MT326	1200
1	30	Gen. Elec.	MT346	600
1	25	Burke	EMV	1200
1	25	G.E. 2200 v.	I-M	900
1	25	F. Morse b.b.	HV	600
1	25	Gen. Elec.	I-M	600
1	20	Wagner	19TRS	900

SYNCHRONOUS MOTORS

H.P.	Mfg.	Type	Volts	Speed
750	Allis Ch.		220/440	1200
200	Elec. Machy.		220/440	600
150	Elec. Machy. New 8 PF		220/440	360

SPEED REDUCERS & GEAR MOTORS
Many sizes, new and rebuilt in stock for prompt shipment.

CENTRIFUGAL PUMPS
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm # 230 ft.
8" Worthington, 2000 gpm @ 200 ft.

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1	200	Gen. Elec.	I-K	600
1	125	Northwn.	H	1800
1	100	Ideal	A	600
1	60	Ideal	A	1200
1	50	Gen. Elec.	FT523	3600
1	50	Allis Ch.	B	900
2	50	Whse. 2200 v. vert.	CS	900
1	40	Gen. Elec.	I-K	900
6	40	Reliance b.b.	C445	1200
1	40	Allis Ch. 3 spd.	ARX	900/600/450
2	30	Reliance b.b.	C444	1200
1	30	Whse.	CCL	600
1	30	Whse. 2200 v.	CS	1800
1	30	Whse. New b.b.	CS365	3600
2	25	Allis Ch.	AN	900
2	20	Gen. Elec.	KT312	1200
2	20	Century b.b. 4 spd.	SC504	1800

25 CYCLE MOTORS

H.P.	Mfg.	Type	Speed
450	Whse. 2200 v.	CW sl. rf.	750
150	Whse.	ED sl. rg.	500
100	Whse.	CCL sq. cg.	500
75	Gen. Elec.	I sq. cg.	750
50	Allis Ch.	ANY sl. rg.	1500

D.C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec. 1	MPC	125/170	1150
100	Fair Morse	TR	250	800
75	Whse.	S	125	600
50	Cr. Wheeler	CCD	250	850
30	Lincoln b.b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
20	Allis Ch. (2)		125	475

60 CYCLE A.C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
750	Allis Ch.		440	1200
400	G.E. 3 brg.	ATB	2300	514
300	G.E. 3 brg.	ATB	2300	450
165	Elec. Machy.	BRKT	240/480	900
150	Allis Ch. 25 cycle		240/480	500
125	Allis Ch.	B	240/480	900
100	Cr. Wheeler	ped.	240/480	600
75	Gen. Elec.	ATB	240/480	900
31	Whse. b.b.	late	120/208	1200

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

DIESEL ENGINES
FOR SALE

1—60 HP Chicago Pneumatic, horizontal, semi.

1—75 HP F-M full diesel.

2—100 HP F-M, 2 cylinder, vertical, semi.

1—200 HP Worthington, 4 cylinder, full diesel.

Several with
A.C. Generators, 240/480 volts.

We buy and sell all types of Pumps, Compressors, Boilers, Processing Equipment and Conveyors.

LOU COHEN
PUMP & MACHINERY CO.

715 Howard Street — St. Louis 6, Missouri

Telephone: GArfield 4290

Electrical Equipment

C. B. LOCKE CO.
P. O. BOX 3227
TEL. 38-136
CHARLESTON, W. VA.

NEW and REBUILT

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers.

MOTORS

1—80 HP. 1200 RPM, CR. WH. 220/440/3/60 Ind.
1—75 HP. 1800 RPM U.S. Line Start 220/440/3/60 Ind. B.B.
1—65 HP. 1200 RPM, GE Type KT 220/440/3/60 Ind.
1—65 HP. 1200 RPM GE Type KT 440/3/60 Ind.
1—40 HP. 900 RPM. Whse. Type CW 440/3/60 Sl. Ring
5—5 HP. 2200 RPM Reliance, Ex. Proof, 230 V. DC.
1—Lot Whse. Type SK, 230 V. DC.
Other AC & DC Motors in Stock.
Cross Line & Reduced Voltage Starters.

TRANSFORMERS

1—200 KVA Kuhlman, Cont. Duty, Auto, 3800-2300/3/60
3—37½ KVA Pitts, Cont. Duty, Auto, 6900-2300/1/60 — A few others in stock.

MOTOR GENERATOR SETS

1—150 KW Ridgeway, 900 RPM, 250 V. D. C. to 225 HP. 2300 volt Syn. complete with control equipment.

SYNCHRONOUS ROTARY CONVERTERS

6 phase 60 cycle

QU.	KW	Make	Speed	D.C.V.	Trans. V.
1	1500	Whse.	450	250	2300/4160
1	500	Whse.	1200	600	#
1	300	Whse.	1200	275	#
2	300	Whse.	1200	600	#
2	150	Whse.	1200	275	#

Transformers, your spec. 3 to 6 months

TURBO ALTERNATORS

Complete with Auxiliaries and Control Equipment
1—3650 KVA 3600 RPM, 2300/3/60, Whse
1—3125 KVA, 3600 RPM, 2300/3/60, Whse

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

DIESEL UNITS

General Motors—94 KVA; 75 KVA; 37½ KVA
Fairbanks Morse—700 KVA; 600 KVA; 250 KVA
Worthington—225 KVA; 125 KVA; 90 KVA
Superior—485 KVA; 93.8 KVA; 62½ KVA
Fulton—144 KVA

A. C. TURBO UNITS

1560 KVA Wghse. (Bleeder)
750 KVA G.E., Cond.
625 KVA Wghse. (Bleeder)
625 KVA Elliott, Non-cond.
375 KVA G.E., Cond.
250 KVA (2) G.E., Non-cond.
125 KVA CW-Moore, Non-cond.
110 KVA Al. Chal.-Kerr, Non-cond.

STEAM ENGINE UNITS (A. C.)

400 KVA G.E.-Nordberg Unif. (Cond.)
187 KVA Wghse.-AMES Unif. Vertical
187 KVA G.E.-Chuse 4 v.
79 KVA Al. Chal.-Ames Unif.

DIRECT CURRENT UNITS (250 V.)

300 KW CW-Cooper Bessemer Diesel
200 KW (2) 250 v. 3 w.-Ames Uniflow Vertical

GENERATORS AND MOTORS SYN.

CONDENSERS

2100 KVA (2) General Electric 514 RPM
375 KVA General Electric 277 RPM
Boilers—Stirling; (4) 500 HP; (1) 327 HP
Transformers; M G Units

SEARCHLIGHT SECTION

BOILERS

2—1047 HP Heine Boilers, 200#
4—30,000# Foster Wheeler 475# pressure boilers with oil burners, 1942.
1—519 HP Titusville, 3 drum, low head, 200# underfeed stoker, new 1935.
1—650 HP Casey Hedges, 225#, new in 1930.
2—500 HP Scotch Marine Boilers, 200# with oil burners.
1—40 HP Leffel Scotch Marine Boiler, 125#.
4—500 HP Stirling Boilers, 200#, ASME.
2—404 HP Springfield, Sectional Header, 200#.

TURBINES

1—6250 KW General Electric, 1800 RPM, Condensing, all auxiliaries.
1—750 KW, 3-60-240 volt General Electric Automatic Extraction.
1—3700 KVA General Electric Condensing Turbine.
1—500 KW General Electric Condensing Turbine

DIESEL ENGINES

3—300 KVA Fairbanks-Morse Full Diesel Engines.
3—200 KVA Fairbanks-Morse Full Diesel Engines.
2—400 KW McIntosh-Seymour, 3-60-2300 volts, all auxiliaries.
2—300 KW General Motors Portable Diesel Engines, 3-60-480 volts.

ENGINE GENERATOR SETS

1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.
1—600 KW Skinner Vertical D.C. Generator.
1—600 KW Non Releasing Corliss, 3-60-240 volts.

MISCELLANEOUS

300 HP Kerr, 3600 Non Condensing Turbine.
2500 HP Cochrane Open Feed Water Heater.
1—10' x 15' Illinois Forced Draft Chain Grate Stoker.
1—300 GPM Pennsylvania Boiler Feed Pump, motor driven.
3—Type E Under Feed Stokers, 600 HP.
2—150 HP Canton Ram-fed Stokers.
2—75 HP Elliott Geared 900 rpm turbines 385# steam pressure.
1—232 GPM Centrifugal Boiler Feed Pump, turbine Driven, 1200 ft. head.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.
325 Fincastle Building — LOUISVILLE, KY.

POWER PLANT SPECIALISTS

SPECIAL OFFERING

1—165 HP 125 lb. Pressure Economic Boiler.
3—1200 HP 600 lb. Pressure Water Tube Boilers oil burning, superheaters, all trim and fittings including soot blowers etc—unused.
2—500 HP Babcock & Wilcox Sectional Steel Header Boiler, superheaters, coal burning.
2—22500 lbs. per hour, 400 lb. pressure Water Tube Boilers, oil fired, superheaters, soot blowers—all trim and fittings.
4—38000 Pounds per hour. Sectional header. Water Tube Boilers—Unused—500# Pressure Complete with Superheaters—Economizers—Oil Burners, Soot Blowers.
1—4000 KW. 400 lb. pressure, condensing turbo generator 3/60/2300/4100 volts.
1—3000 KW. 200 lbs. pressure turbo generator, condensing 3/60/2300 volts.
BOILERS, water tube and portable type, 100 HP up to 2500 HP up to 750 lbs. pressure.

NOTE TO READER

The rapid turnover of our stock has made us feel we cannot publish a complete list of current offerings.

State your needs—We will post you promptly.

Our present stock consist of over 5000 items, in our warehouse consisting of all types of TURBO GENERATORS, SWITCHGEAR, AIR and OIL CIRCUIT BREAKERS, RELAYS of all types, TRANSFORMERS, PUMPS, 800 VALVES—NEW and USED, up to 1500# pressure, and other items in Industrial and Power Plant Construction.

HOWE BROTHERS

324-328 PEARL ST., NEW YORK 7, N. Y.

Phone—Worth 2-2708—2709—2710

PUMPS

Rebuilt & Guaranteed

PUMPS—Large stock centrifugal—turbine—piston.

STEAM PUMPS—Duplex - Simplex. Reconditioned and guaranteed.

BOILERS—stacks—Engine Generators—condensers.

LOU COHEN
PUMP & MACHINERY COMPANY
715 Howard St. St. Louis 6, Mo.
Telephone - GArfield 4290

DIESEL GENERATOR UNIT

1500 H.P.—1250 KVA
Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
Immediate Stock Delivery Rebuilt
A. G. SCHOONMAKER COMPANY
50 Church St., New York 7, N. Y.
Phone Worth 2-0455

• • • MOTOR GENERATOR SETS • • •

DC Motor to Single Phase Generator

10—115 volt DC 4 HP direct connected to single phase 60 cycle, 2.22 KW, 1800 RPM generator. New in original crates. Made to sell for $495.00 each.

195.00 each

THE MOTOR POWER CO. OF NEW YORK, INC.

859 Madison Avenue — **New York 21, N. Y.**
RHinelander 4-6478

POWER PLANT MACHINERY

Uniflow Engine Generator Units.
Steam Turbine Generator Units.
Diesel Engine Generator Units.
100 to 2000 K.V.A. Boilers New and Used—100 to 1000 HP.

BRILL EQUIPMENT CO.
225 West 34th Street,
New York 1, N. Y.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

STEEL TANKS

9—8 ft. x 45 ft. Horizontal.
30—10,000 Gal. Cap. Horizontal.
250—4,000 Gal. Cap. Vertical.
7—42,000 Gal. Cap. Vertical.
3—5,000 & 10,000 Bbl. Cap. Vertical.

L. M. STANHOPE
Rosemont, Penna.

APPLICATION ENGINEERS

45 KW M. G. Set 2200 AC 250 DC.
100 KW. M. G. Set 220/440 AC 125/250 DC.
300 KVA Fairbanks Morse Diesel Set.
200 KW 480 volt Ridgway Engine Set.
2500 KW 2300 volt 200 lb. GE Cond. Turbine.
150 HP 720 rpm 2200 volt GE Cage Motor.
HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Ill.

KIEMLE OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D.C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D.C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO

Put all idle equipment to work. Send your list for prompt action. **WRITE OR WIRE YOUR INQUIRIES**

Rebuilt Power Transformers

SINGLE PHASE—OISC

3—2000 KVA GE 13200/26000 to 2300 V.
7—4000 KVA GE 15950/27600 Y to 13,800/6900/4160 V.
3— 667 KVA Packard 23000 to 460/230 V.
6— 667 KVA 11000/22000 to 440 V.
3— 750 KVA GE 13200/2300 V.
3—2000 KVA Whse. 33000 to 11000 V.
2— 400 KVA Al. Ch. 66000/2300/4000 Y.
2—1200 KVA Whse. 66000/2300/4000 Y.
3— 333 KVA GE. 11500 to 2300 V.
3—2000 KVA 33000 to 13,200/6600 V.

THREE PHASE

1— 3000 KVA GE. 11600 to 440 V.
1— 1200 KVA Whse. 6600 Y to 2300 V.
1—15000 KVA Pitts., 27880 to 4560Y. V.

WATER COOLED

4—3333 KVA GE 25/60 cy. 60000 to 4000/6925Y/8000/13850.
3—1500 KVA Al. Ch. 33000 to 13200/6600 V.

PYRANOL

1—3000 KVA Penna. 25 cy. 13,800 to 480 V., 1 ph.
19—37½ KVA Penna. 440 V. to 220 V. 60 cy., 1 ph.
9— 100 KVA Penna. 2200/220/110, 60 cy., 1 ph.

NETWORK TRANSFORMERS

19—150 KVA GE, type Ht, late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.
8—200 KVA GE, type Ht, late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.

PHILADELPHIA TRANSFORMER CO.
2829 Cedar St. **Phila., Penna.**

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

SLIP RING MOTORS—3 Ph., 60 Cy.

Cu.	HP	Volts	Speed	Make	Type
2	40	2200	865	Al.-Ch.	ARY-223C
5	52	220*	550	G.E.	IOC-5013***
1	60	2200	1200	G.E.	MT-B-343
1	60	550	570	G.E.	MTC-5546
1	75	550	720	G.E.	MT-556
1	75	220*	1750	West.	CI-653 C
1	80	440*	575	G.E.	MTC-5352
1	100	220*	1760	Al.-Ch.	ARY-223BS
2	125	440*	430	G.E.	IL-16
1	150	550	385	G.E.	IM-17
1	150	2300	490	West.	CW-956A
2	200	550	600	G.E.	IM-17
3	250**	220/380	296	West.	CW-20-53-15
2	300	550	514	G.E.	IM-17A
1	400	550	505	West.	CW

* Can be furnished either 220 or 440 volts, but not both voltages.
** 50 Cycle (New). *** 2 Phase.

CRANE and MILL TYPE 230 VOLT D.C. MOTORS

Qu.	HP	Speed	Make	Type
2	3½	700	G.E.	CO-1803
2	10	690	West.	K-4
3	13	575	G.E.	CO-1806
3	25	590	Diehl	TE
1	27	490	West.	MC-40
1	50	600	West.	CK-9
5 (New)	50	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (New)	60	550	G.E.	COM-1831AE
4	65	450	G.E.	CO-1830

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qu.	HP	Volts	Speed	Make	Type
1	25	2200	1140	West.	CCL
1	30	220*	870	West.	CS-646
2	30	440*	1160	West.	CS-644
1	50	2200	900	G.E.	KT-346
1	50	220*	850	West.	CCL
1	75	2200	1750	West.	CS-76
1	100	2200	495	Al.-Ch.	AN
1	100	2200	580	G.E.	IK-15
2	100	2200	500	West.	CS-930-39
1	150	440*	580	West.	CCL
5	150	440*	1800	Howell	N-684
5	200	550 ≠	580	G.E.	KT-5668
1	200**	500	2950	West.	CS-8120-TEFC
1	700	2300/4000	1800	West.	CS-4-39D-12

* Can be furnished either 220 or 440 volts, but not both voltages. ** 50 Cycle (New).
≠ Reconnectable for 440 volts.

230 VOLT ADJUSTABLE SPEED D.C. MOTORS

Qu.	HP	Speed	Make	Type
10	1½/2	500/2000	G.E.	CD-65
1	2	225/900	Reliance	78T
6	5/7½	600/1800	G.E.	RA-30
1	12½	280/840	West.	SK-130
10 (New)	12½	600	West.	SK-93
1	23/29	300/1200	G.E.	RF-13
1	35	500/1500	West.	SK-143
3	40/50	400/1600	Al.-Ch.	EB-147
1	75	500/1500	Cr.-Wh.	CCM
5	50	400/1200	Al.-Ch.	.....
3	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

VARIABLE VOLTAGE DRIVES (2)

40 HP, Reliance Variable Voltage Ward Leonard Drives each consisting of:

1—40 KW, 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP, 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
2—Auxiliary, 5 HP, 900/1800 RPM, Frame 23-T, D.C. Motors.

With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

The above Listings Are Representative of Items Available for Prompt Shipment from Our Cleveland Warehouse. We Also Have a Large Stock of Synchronous Motors, Constant Speed DC Motors, Rotary Converters, AC and DC Generators, Circuit Breakers and Control Equipment.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. **CLEVELAND 14, OHIO**

TRANSFORMERS

REWOUND - REBUILT
Bought - Sold - Exchanged

IN STOCK

1—600 KVA Westinghouse 3 ph.
1—1000 KVA G.E. single ph.
2—750 KVA Pittsburgh Single ph.

BURNT OUT TRANSFORMERS PURCHASED.

Zenith Transformer Co.
1733 N. 5th St. **Phila. 22, Pa.**
Phone 5-0553

1-75 KW M/G Set

G.E. Factory Built Generator
75V, 1000 Amps.
Motor: 115 HP Type IQ Induction
ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. **Philadelphia 22, Pa.**

TRANSFORMERS

3—75 KVA Maloney 60 cy., 1 ph. 13200-260/520
1—250 KVA G.E. 60 cy., 1 ph. 7800-460
1—75 KVA Maloney 460-230/115, 60 cy., 1 ph.
200 Auto Boosters 15 and 25 KVA, 208, 230/240, 3 ph.
136—1 KVA 4400-110/115/120, 60 cy., 1 ph.

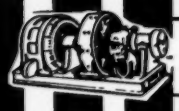
New or used. All types and sizes

ATLANTIC TRANSFORMER CO.
TRANSFORMER SPECIALTIES
5143 N. 2nd St. **Philadelphia, Pa.**

BENJAMIN

NEW • ELECTRIC • STEAM • AIR EQUIPMENT
Thousands of Items A/C or D/C from 1 to 500 K.W.

WIRE, MAIL, or PHONE Your Requirements



USED EQUIPMENT Thoroughly Overhauled, Tested & Approved AND GUARANTEED for 1 full year

Agents for Most Popular Make of Motors

BENJAMIN'S RELYABILT EQUIPMENT

Benjamin's for Motors
ESTABLISHED 1904
130 CLINTON STREET ★ BROOKLYN, N. Y.
Windsor 5-1700

Thousands of Items - A/C or D/C. From 1 to 500 KW

OVERHEAD CRANES

1-Ton Shepard 12' Span
Detroit 38' Span
2-Ton Conco 27'6⅛" Span
Shaw 16'3" Span
3-Ton Shaw 33' Span
Shaw 32' Span
P&H 42'1½" Span
P&H 48' Span
5-Ton Whiting 25'6" Span
Shaw 47'4" Span
Whiting 47'4" Span
Champion 37'6" Span
P&H 40' Span
Northern 30' Span
Detroit 36'6" Span
Milwaukee 85' Span
6-Ton Northern 46' Span
7½-Ton Northern 26'7½" Span
10-Ton Alliance 58'9" Span
Alliance 100' Span
Gilbert 60' Span
Shepard Niles 27'7½" Span
Morgan 55'6" Span
Shepard Niles 40' Span
Whiting 37' Span
Toledo 77' Span
Shaw 80'9" Span
Ederer 70' Span
Case 80' Span
American 27' Span
P&H 87'6" Span
Niles 75'½" Span
12½-Ton Niles 75'1" Span
15-Ton Euclid 84'3" Span
Morgan 73'5½" Span
Gilbert 60' Span
P&H 32' Span
P&H 97' Span
Morgan 82' Span
Bedford 34½' Span
Lane 58' Span
Whiting 71'10½" Span
Whiting 47'1½" Span
20-Ton Dominion 60' Span
Gilbert 60' Span
25-Ton American 100' Span
Ederer 66'8" Span
Leonard Burke 100' Span
Shaw 58' Span
Tysaman 60' Span
30-Ton Ederer 76' Span
Ederer 40' Span
Ederer 60' Span
Northern 75' Span
P&H 77'2" Span
40-Ton Niles 151' Span
P&H 77'2" Span
Shepard Niles 49' Span
50-Ton Cleveland 71'10½" Span
P&H 40' Span
Shaw 95' Span
150-Ton Whiting 30' Span
200-Ton Alliance 100' Span

Telephone us collect to discuss your requirements

ECONOMY COMPANY, Inc.

49 Vanderbilt Avenue Telephone: MUrray Hill 4-1616 New York 17, N. Y.

NEW CHRYSLER DIESEL POWER UNITS

75 H.P. Model IND-3, 6 Cylinder, Electric start, includes: 4 Batteries, Radiator, and Spare Parts.

ROSS HEAT EXCHANGERS TYPE BCF

BCF LUBE OIL COOLERS

"YOUNG" RADIATORS 42" x 65"

ALL NEW. Immediate Shipment, limited supply.

ALJON ELECTRIC DIESEL CO.

904-10 Pacific St. Brooklyn 16, N. Y.
Sterling 3-6515

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

"Export Orders Carefully Executed"

SPECIAL OFFERING

3—90,000# Boilers 575#
4—100000# Boilers 275#
1—225000# Boiler 450#
4—1000 H.P. Heine Boilers 225#
2— 825 H.P. B. & W. Sterling Boilers 200#
4— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
4— 500 H.P. Heine 200 lb. Boilers
Smaller Boilers and Fire Tube Boilers also

Several 425# and 550# Turbo-Generators available
20,000 K.W. GE Co. turbo-generators condensers
1—10000 K.W. G.E. Co., Turbo-Generator Condensing
2—3000 K.W. Turbos @ 350#
1—5000 K.W. G.E. Co., Turbo-Generator Condensing
2—2500 K.W. G.E. Co., Turbo-Generator Condensing
2—2000 K.W. G.E. Co., Turbo-Generator Condensing
1—2000 K.W. W.E. & M. Co., Turbo-Generator Con.
2—1000 K.W. G.E. Co., Turbo-Generator Condensing
2— 750 K.W. G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller Units.

Non-Condensing Turbos—300—500—750—and 1000 K. W. & Larger

CHARLES B. REARICK 30 CHURCH ST. NEW YORK

VALVES

INDUSTRIAL & MARINE

METROPOLITAN PLUMBING SUPPLY CO., INC.

Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24"
313 E. 31st NEW YORK CITY
Call MUrray Hill 3-3406
For Hourly Nationwide Shipments

SKETCH PIPE & FITTINGS

WURTH for "WORTH"!

A. C. GENERATORS 3 PHASE—1 PHASE 15 to 62½ KVA

LARGEST STOCK OF A.C. AND D.C. MOTORS FROM 5 TO 200 H.P.
D.C. MOTOR GENERATOR SETS TO 75 KW ● HIGH CYCLE GENERATORS
Send For Our Latest Stock List

WURTH ELECTRIC MOTOR COMPANY

Motors, Generators, Alternators, Frequency Changers.
141 GRAND ST. — CAnal 6-6138 — NEW YORK CITY

FOR SALE

SPEED REDUCERS

New Link Belt 225 H.P. Type SW-12, Ratio 1-3.67. Agma service factor 1.

Seven Available, Very Reasonable

THE FINN EQUIPMENT CO.

2525 Duck Creek Rd., Cincinnati 8, Ohio
Phone—EAst 1125

BERGER OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGERS SETS

MOTOR GENERATOR SETS
ALTERNATORS ALL FREQUENCIES
TRANSFORMERS LARGE STOCK
D. C. GENERATORS ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES, VOLTAGE AND CYCLES

3 ph. 60 cy. A. C. Motors
3 ph. 25 cy. Motors
125 Volt D. C. Motors
230 Volt D. C. Motors
550 Volt D. C. Motors

WRITE OR WIRE YOUR INQUIRIES

BERGER BROTHERS Electric Motors, Inc., 395 STATE ST., ROCHESTER 4, NEW YORK

PUT ALL IDLE EQUIPMENT TO WORK. SEND YOUR LIST FOR PROMPT ACTION

BOILER & POWER EQUIPMENT

4—New and unerected 250 lbs. to 450 lbs. steam pressure Sectional Header B & W Boilers, 58,000# steam maximum each, with or without superheaters and economizers, oil burners and new brickwork.

6—New and unerected 250 lbs. to 450 lbs. steam pressure Sectional Header Combustion Engineering Co. Boilers, 58,000# steam maximum each, with or without superheaters and economizers, oil burners and new brickwork.

8—New and unerected 250 lbs. to 450 lbs steam pressure Sectional Header Foster-Wheeler-Vogt Boilers, 41,000# steam maximum each, with or without superheaters and economizers, and oil burners, but without brickwork.

Above new boilers offered at less than ½ today's cost.

7—New and unused Cochrane Deaerating Heaters 79,000# steam each per hour.

7—New and unused Cochrane Deaerating Heaters 49,000# steam each per hour.

3—New 8200 Sq. Ft. Surface Condensers ¾" Tubes.

5—New 580 Sq. Ft. Surface Condensers ¾" Tubes.

Also new circulating pumps, condensate pumps, air ejectors, and heat transfer equipment.

Sundfelt Equipment Co. Inc.
3422 First Av. So., Seattle, Wash.

BOILERS

NEW—USED

Large Stock . . . **Immediate Delivery**

6—NEW Cyclotherm Steam Generators Complete 100# W.P.
1—NEW 25 H.P. Steam Generator Complete 125# W.P.
1—25 H.P. Hamburg Vertical with Automatic Oil Burner 125# W.P.
1—NEW 32 H.P. Kewanee Firebox Type comp. with Stack, Oil Burner, also Coal Grates 100# W.P.
1—60 H.P. Erie City Hand Fired Grates ASME 100# W.P.
1—80 H.P. Erie City Hand Fired Grates ASME 100# W.P.
1—NEW 80 H.P. Steam Generator 125# W. P.
12—90 H.P. Cyclotherm Steam Generators 125#
2—NEW 100 H.P. Steam Generators 125# W.P.
2—100 H.P. Titusville Firebox Type 150# W.P.
1—125 H.P. Erie City Economic ASME Hand Fired Grates 125# W.P.
1—150 H.P. Scotch Marine 115# W.P.
1—150 H.P. Scotch Marine 150# W.P.
1—200 H.P. B & W Sectional Header 25# W.P.
2—250 H.P. Heine 180# W.P. with Westinghouse Stokers
2—250 H.P. B & W Stirling 200# W.P.
2—300 H.P. Oil City (Heine Type) Hand Fired Grates 160# W.P. ASME
1—489 H.P. Heine ASME 160# W.P. Hand Fired Grates Extra Equipment
2—500 H.P. B & W Sectional Header 200# W.P.
2—600 H.P. Springfield Sectional Header ASME 200# W.P.

Call—Write or Wire

J. PARKER THOMPSON CO., INC.
507 Fifth Ave., Murray Hill 7-6547-8-9, New York 17, N. Y.

Turbo Generator, G. E. Automatic Extraction. 933 KVA 220/440 Volt. 60 cycle.
Steam Engine with alternater direct connected 100 K.W. 220 volt 3 phase, 60 cycle.
Motors, 3 Phase 60 Cycle 220 Volt, 1140 and 1750 RPM. All sizes, ½ to 30 H.P.
Pipe, 1½" to 10", New, Black and Galvanized.
Gasoline Storage Tank, 18,000 gallon.
Aluminum Corrugated Roofing, new Aluminum, Flat Sheets, Soft, new Condensers, 2000, 1500 and 1000 sq. ft.

B. C. SKINNER MACHINERY CO.
DUNEDIN, FLORIDA, Telephone 83601

BRONZE IRON **PUMPS** ALLOY METALS
ELECTRIC–STEAM–GASOLINE DRIVEN.
All Makes – Capacities – Pressures.
Centrifugal – Rotary – Plunger – Turbine.

MOTORS 1-2-3 PH. & D. C.
STANDARD EQUIPMENT – UP TO 200 H.P.
Generators – Welders – Dynamos.
New & Rebuilt Guaranteed Machines.

TURBO BLOWERS
SPENCER–INGERSOLL RAND–ALLEN BILLMYRE. For Heat Treating – Brazing Furnaces – Smelting – Vacuum Duty Etc.

TURBINE PUMP
BOILER FEED
VERTICAL ENGINE
VACUUM RETURN
STEAM UNITS

AIR COMPRESSORS
ALL TYPES–CAPACITIES 1 to 1000 "CFM"
Electric – Gasoline – Steam Driven.
For Industrial – Mine Construction.

VACUUM UNITS
FOR STEAM – AIR – GAS – FLUIDS.
All Makes – All Capacities – Tested.

FANS–EXHAUSTERS
CAPACITIES FROM 25 to 100000 CFM.
VENTILATING – SUCTION – BLOWING
Air – Dust – Gases – Steam Vapors.

MACHINERY
CHEMICAL & INDUSTRIAL EQUIPMENT.
ELECTRIC MIXERS–PORTABLE & STATIONARY.

SUPERIOR EQUIPMENT CO.
138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

MOTORS (Rebuilt) IN STOCK

Direct Current

H.P.	Make	RPM	Volts
1/2	Whse.	550	230
1/2	Whse.	550	230
1/2	Whse.	600	220
1/2	Whse.	550	230
3/4	G.E.	1725	110
1	G.E.	1150	230
1	G.E.	3450	230
1	Cr. Wh.	900	230
1	G.E.	1150	220
1	G.E.	1170	230
1	G.E.	1140	230
1½	Whse.	1180	230
1½	Whse.	1200	220
2	Star	3400	230
2	G.E.	3450	230
2	G.E.	2200	230
2	Cr. Wh.	1600	230
2	Master (Geared head)	1725	230
2½	El. Dy.	1350 to 3000	230
2½	Fort Wayne	600 to 1800	230
3	Al. Ch.	1150	230
3½	Cr. Wh.	1150	230
5	G.E.	1600	550
5	Star	1200	525
5	Star	1200	525
5	G.E.	800	500
5	G.E.	3450	230
5	G.E.	1000	110
5	Cr. Wh.	1875	230
5	N. W.	1150	220
5	Al. Ch.	1150	220
5	Peerless (with base)	1480	220
5	Al. Ch.	1500	220
5	Jenney Elec.	1700	220
5	N.W.	1150	230
5	Cr. Wh.	1425	230
5	Whse.	400 to 1600	230
5	G.E.	1600	550
7-2/10	Deihl El.	1150	230
7½	Whse.	3450	230
7½	Whse.	850	230
7½	El. Dy.	550 to 1100	575
7½	N. W.	1750	220
7½	Star	1800	230
7½	Bullock	1650	500
7½	G.E.	500 to 1000	500
10	Sprague	1700 to 1950	220
10	El. Dy.	600 to 1200	230
10	Cr. Wh.	850	500
10	G.E.	1150	500
10	G.E.	1125	500
10	G.E.	1500 to 1800	400/600
11½	W. E.	650	230
15	Reliance	850	230
15	Whse.	Variable	230
15	Whse.	825	230
20	Cr. Wh.	1830	240
20	(no name plate)		
25	Whse. (Crane)	570	500
25	G.E.	865	550
50	Whse.	840	500
66	G.E. (Crane)	520	230

ALTERNATING CURRENT

3 phase, 60 cycle

1	Phoenix, with base	1800	220
1	G.E., 4-speed	1800/1200 900/ 600	220
1	Hobart	1800	110
2	Whse.	3450	110/220
3	Whse.	850	220/440
5	B-line	1750	440
7½	Triumph	1800	440
7½	Phoenix	1800	220
7½	Whse., Vertical	1740	440
7½	Whse., S. R.	870	220
7½	Fort Wayne, S. R.	1200	220
10	Al. Ch., S. C.	680	440
15	G.E.	865	440
15	G.E.	865	440
15	W. E.	865	220
15	G.E.	865	440
15	G.E.	865	440
15/35	Whse., S. R.	575/1160	440
20	G.E.	1155	2200
20	G.E., S. R.-base	855	2300
20	G.E.	855	2200
20	Al. Ch., S. R.	860	440
20	G.E., S. R.	865	440
25	Watson	1140	220
25/12½	L.-A., 2-sp. with base	900/450	220
25	G.E., S. R.	670	220
35	G.E. with base	600	2200
35	G.E.	860	440
50	Fynn-Weichsel	1800	220
50	G.E., S. R.	860	2200
50	Whse.	1160	2200
50	Al. Ch., S. R.	580 (Will not reconnect for 220/440)	2200
75	G.E.	575	2200
100	G.E.	430	2200
150	G.E.	575	2200

Guyan Machinery Co.

LOGAN, WEST VIRGINIA

FOR SALE

MILL MOTOR AND MOTOR GENERATOR SET

— COMPRISING —

1—900 HP GENERAL ELECTRIC REVERSING MILL TYPE MOTOR 600 VOLT, 200/600 RPM, SERIAL #1700319.

1—750 KW GENERAL ELECTRIC MOTOR GENERATOR SET—SERIAL #5406505 WITH 1000 KVA TYPE TS SYNCHRONOUS MOTOR, 3/60/4600 VOLTS, 900 RPM, DIRECT CONNECTED TO 750 KW GENERATOR 900 RPM, COMPLETE WITH EXCITER, MOUNTED ON COMMON BASE.

1—150 KW GENERAL ELECTRIC SURFACE COOLER, 20,000 CU. FT. PER MINUTE.

For full details, write, wire, phone:

Industrial Plants Corporation

90 WEST BROADWAY, NEW YORK 7

BArclay 7-4185

NEW D. C. STARTERS

Offered at 50% of list prices.

3— 1 HP, 115 volt, DC Ward Leonard Automatic motor starter—reversing—time limit type with dynamic brake
2— 2 HP, 115 volt, Square D, DC magnetic starter, class 7135, type SG4
2— 2 HP, 115 volt, DC Ward Leonard Automatic motor starter—reversing—time limit type with dynamic brake
1—1½ HP, 115 volt, DC Ward Leonard Automatic motor starter
4—1½ HP, 115 volt, DC Ward Leonard Automatic motor starter—reversing—time limit type with dynamic brake
1— 20 HP, 115 volt, Square D, DC magnetic starter, class 7735, type VG2
1— 3 HP, 115 volt, Square D, DC magnetic starter, class 7135, type SG4
2— 5 HP, 440 volt, 3 phase, 60 cycle, Square D magnetic line starter, class 11200FN—So3B3089
1— 10 HP, 115 volt, Square D, DC magnetic starter, class 7135, type UG4
1— 15 HP, 115 volt, Square D, DC magnetic starter, class 7135, type VG4
1— 5 HP, 115 volt, Square D, DC magnetic starter, class 7135, type TG4
24—G. E. CR1061-F motor starting switches manually operated, ¾ HP, 115/230 volt, DC cat. No. 4988807H Marine
46— Allen Bradly type 3SA, Bul. 800, forward reverse and stop switch

PORTER ELECTRIC COMPANY, INC.

330 South Sixth Street Minneapolis 15, Minnesota

GEneva 8655

ELECTRICAL EQUIPMENT COAST TO COAST

ELECTRIC GENERATING SETS

(Used—Reconditioned)

50 KW AC 3 ph. 127/220 v 50/60 cyc. 4-wire Hercules Diesel engine, switchboard
28 KW AC 3 ph. 220 v 60 cyc. Hercules gasoline engine, switchboard
30 KW AC 3 ph. 127/220 v 50/60 cyc. 4-wire Buda Diesel engine, switchboard
25 KW AC 3 ph. 110/220 v 60 cyc. 4-wire LeRoi gasoline engine, switchboard
15 KW DC 120/240 v 3-wire Hill Diesel engine, switchboard

ACE MACHINERY & EQUIPMENT COMPANY
Constitution & Terminal Sts.
Baltimore 2, Maryland

FOR SALE

1—467 H. P. Stirling, 4 Drum,

BOILER

Manufactured by Babcock & Wilcox Company, Design Pressure 250#/0. Installed 1926. Now in operation and approved by Hartford for operation at above pressure.

This boiler may be inspected at

Municipal Water, Light & Power Plant
City of Gainesville, Florida
Boiler will be available for removal about April 15, 1947.

Everything from a Pulley to a Powerhouse

NEW—TRANSFORMERS—OISC
SINGLE PHASE—60 CYCLE

Qu.	KVA	Primary	Secondary	Delivery
6	100	2400/4160Y	240/120	March-April
9	100	2400/4160Y	220/440	March-April
6	75	2400/4160Y	120/240	March-April
9	75	2400/4160Y	220/440	March-April
9	50	2400/4160Y	220/440	March-April
6	50	2400/4160Y	120/240	March-April
9	37½	2400/4160Y	220/440	March-April
6	37½	2400/4160Y	120/240	March-April
9	25	2400/4160Y	220/440	March-April
3	25	2400/4160Y	120/240	March-April

1055 CFM AIR COMPRESSOR SYNCHRONOUS MOTOR DRIVEN IN STOCK—IMMEDIATE SHIPMENT NEW 1943

1—18 & 11 x 12 CHICAGO PNEUMATIC type OCE, 1055 CFM displacement, 100 lb. pressure, direct connected to 175 HP WESTINGHOUSE 440/3/60/300 Synchronous Motor. Motor Generator Set and Panelboard, Air Receiver and Aftercooler.

—AIR-COOLED—
SINGLE PHASE—60 CYCLE

Qu.	KVA	Primary	Secondary	Delivery
6	25	440/220	220/110	March-April
6	15	440/220	220/110	March-April
6	10	440/220	220/110	March-April
9	7½	440/220	220/110	March-April
9	5	440/220	220/110	March-April
6	3	440/220	220/110	March-April
6	2	440/220	220/110	March-April

NEW—COMPENSATORS—60 CYCLE

Qu.	H.P.	Voltage	Delivery
20	25	440	March
25	30	220	March
10	50	220	Mar/Apr/May
10	50	440	Mar/Apr/May
10	75	440	Mar/Apr/May
10	75	220	Mar/Apr/May
10	100	220	Mar/Apr/May
10	100	400	Mar/Apr/May

THE O'BRIEN MACHINERY CO.
113N. 3rd St. Phila. 6, Pa.

$1,000,000 Inventory
New and Rebuilt

AC MOTORS 60 CYCLE

AC MOTORS 25 CYCLE

DC MOTORS

MOTOR GENERATOR SETS

SELL US YOUR SURPLUS MOTORS

ASK FOR Catalogue 106

ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

STEAM PUMPING ENGINES

1—Snow 8MGD C&FW cr. Com. Opp. Type Cond. 26x54x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20x40x14¾x36 with waterworks type con.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. All fine cond.
1—Worth Cr. Comp. Cr. & Fly wheel LDG Meyer Valve gear, 1 MGD, size 14x28x9¼x18.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago 10, Ill.

When you buy used power equipment,
BUY it complete on foundation Ready to operate.
I have Vertical steam engine units, Turbine units, and diesel units, Boilers.

What do you need?—What have you to sell?

Let me have your inquiries

ROBERT B. BICKEL SR.
Erecting Engineer
1414-15 Dime Building Detroit 26, Michigan
Phone RAndolph 3050

FANS

2—#7½-Turbo Conodial Multivane Fans—8 sq. ft. Outlet—Cap. 10,000 to 30,000 F.P.M. Control Gates.

JOHNSON & HOEHLER INC.
LANSDOWNE PENNA.

DIESEL ENGINE

1—240 HP Fairbanks Morse, 4 cylinder Model 32, Style VA, 257 RPM Diesel Engine Serial No. 705946, 14 x 17 with 8" shaft, 6'6" x 10" flywheel, in operating condition, not overhauled, offered at $2,000.00 on foundation Minnesota shipping point.

PORTER ELECTRIC COMPANY, INC.
330 S. 6th St. Minneapolis, 15, Minn.
GENEVA 8655
Electrical Equipment Coast to Coast.

FOR SALE

2—160 h.p. Waukeshaw Natural Gas Engines with 125 KVA Generators
1—175 h.p. Model T, Foos Natural Gas Engine
2—80 h.p. Bruce McBeth Natural Gas Engines
2—250 h.p. Foos Natural Gas Engines direct connected to 219 KVA Generator
1—300 h.p. Miller Natural Gas Engine—200 KW Generator
2—400 h.p. Rathbun Jones Natural Gas Engine with Generator
1—400 h.p. Cooper Bessemer Natural Gas Engine
5—100 h.p. Y.V. Fairbanks Morse with clutches or generators
2—120 h.p. YVA Fairbanks-Morse with clutches or generators
4—240 h.p. YVA & Model 32, Fairbanks-Morse with clutches or generators
2—360 h.p., Model 32, Style VA, Fairbanks-Morse with 300 KVA generators

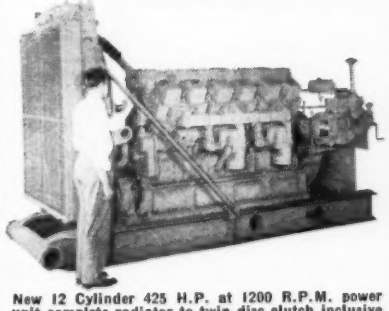
Other Units 75 h.p. up to 520 h.p.; also Steam Units, 37½ KW to 450 KW

A. C. ASKEW
Box 3073, Whittier Sta.
Tulsa 8, Oklahoma

FOR SALE

CLIMAX

BLUE STREAK MODEL V-425



New 12 Cylinder 425 H.P. at 1200 R.P.M. power unit complete radiator to twin disc clutch inclusive with gasoline starting engine. Designed for efficient operation on natural gas, city gas, sewage gas, butane or gasoline. Priced far below factory list. 4 units available. Dealers invited.

THE FINN EQUIPMENT CO.
2525 Duck Creek Rd., Cincinnati 8, Ohio
Phone EAst 1125

POWER PLANT MACHINERY

Sealed Bids

2—1500 KW. Turbo-Generator Units with auxiliaries as listed.—
- 2 Turbines—GE, Condensing, RPM 3600, 170 lbs. pressure.
- 2 Generators—GE, RPM 3600, Cycles 60, 2300 volts, 3 phase.
- 1 Surface Condenser—Worthington, 4000 sq. ft.
- 1 Surface Condenser—Worthington, 6000 sq. ft.
- 2 Condensate pumps—Worthington, 2 inch discharge, GPM66 at 1150 RPM, head 55 ft., driven by 7½ HP, 3 phase, 60 cycle, 220 volt motors.
- 2 Exciters—2 GE Motor Generator Sets; 20 KW, DC, generator, 125 volts, RPM 1800 driven by GE 30 HP motor, 3 phase, 230 volts, 60 cycle, 1800 RPM.
- 2 SW. BD. Exciter Panels—GE.
- 1 Synchroscope, GE.

1—500 KW Turbo-Generator Unit with auxiliaries as listed.—
- 1 Turbine—GE, condensing, RPM 3600, 170 lbs. pressure.
- 1 Generator—GE, RPM 3600, cycles 60, volts 2300, 3 phase.
- 1 Surface Condenser—Worthington, 2000 sq. ft.
- 1 Condensate Pump—1½ inch discharge, driven by 7½ HP, 220 volt, 3 phase, 60 cycle motor.
- 1 Exciter—Western Electric Mg Set; 15 KW Shunt Wound, 1150 RPM, 125 volt, DC generator, driven by 60 cycle, 220 volt, 1145 RPM, 20 HP motor with starting compensator.

1—Steam driven Exciter—80 HP Harrisburg Engine, Piston Valve type, 9 inch bore, 13 inch stroke, 170 lbs. pressure, RPM 250; driving a 50 KW, GE, DC Generator, 125 volt, 250 RPM.

1—20 ton hand operated crane (engine room type), 50 ft. span, 85 ft. of operating track. Extra good condition.

86—Lineal feet 12 inch extra heavy flanged, WI pipe.

2—12 inch extra heavy, CI T's.

1—12 inch, extra heavy, CI, 90 degree elbow.

2—Extra heavy, CI, 12 inch by 12 inch by 6 inch reducing T's.

1—Extra heavy, CI, 12 inch by 12 inch by 4 inch reducing T.

1—Extra heavy, CI, 12 inch by 12 inch by 3 inch reducing T.

50—Lineal feet 20 inch, WI pipe.

50—Lineal feet 12 inch, WI pipe.

All equipment was in operation during the War, feeding into TVA lines. Material may be inspected at the Municipal Light Plant of the City of Nashville, Tennessee, 410 First Avenue, North.

Sealed bids shall be addressed to the City clerk of the City of Nashville, Tennessee. All bids shall be made on an "as is and whre is" basis. All bids will be opened and awards made on April 15, 1947. The City of Nashville, Tennessee, retains the right to reject any or all bids.

Terms of sale are cash on delivery to purchaser on premises.

The purchaser shall execute a bond in the sum of up to $5,000.00 indemnifying the City of Nashville against damage occuring in removal of said material.

Complete Railway Substations

FOR SALE

Motors—2300 - 3 P. - 60.

No. 1—West. MG Set, SYN, 720 H.P.—900 RPM. 2—300 KW, 600 V. Gen. with GE Automatic Switchgear

No. 2 and 3—Each GE, MG Set, Ind. 750 H.P.—714, RPM 500 KW GEN. 1200 volt with GE Automatic Switchgear

No. 4—West. MG set, Ind., 585 H.P.—500 RPM 400 KW—600 V.—manual switchgear.

No. 5—GE MG set, Ind., 450 H.P.—720 RPM —300 KW.—manual switchgear.

Indoor Transformers

6—GE—H.P. 275 KW—17/34/60 KVY to 2200/2000 water cooled.

3—West.—275 KVA—35/60 KV to 2200 air cooled

A. E. Smith & L. O. B. Lindstrom
Electrical and Mechanical Engineers
145 ERIE STREET
San Francisco 3, California
TEL. HE-7313-7158

1—Nordberg Uniflow 150 H.P. high efficiency engine, 1938, No. 31420, direct connected to:
Crocker-Wheeler D.C. Generator, type CCD, size 139-D, 225 R.P.M., 250 volts, 500 amps, No. 747545, 125 K W., continuous at 40° C.

1—Filer-Stowell Corliss Engine, 150 H.P., 1913, overhauled 1942, direct connected to:
Crocker-Wheeler D.C. Generator, type CCD, size 209-D, 125 R.P.M., 250 volts, 500 amps, No. 141360, 125 K.W.

Above equipment in first class condition.

Please make us an offer

MILWAUKEE LACE PAPER COMPANY
1306 E. Meinecke St. Milwaukee, Wis.

MURRAY BOILER

300 HP Single long drum straight tube 180#, 100° superheat. Code. Full trim, Diamond soot blower. Crane nonreturn valve. Copes regulator. Taylor underfeed stoker. Offer at bargain.

F. W. HAY & COMPANY
2734 Cherry St. Kansas City 8, Mo.

FOR SALE

One G.E. Static Condenser #50285, indoor type, 60 cycles, 300 KVA, 2300 Volts, with reactor and oil circuit breaker.

Three G.E. Transformers, 200 KVA, WC type, 60 cycles, 2200/1980—230/460.

One Panel Switchboard.

One Northern Engineering 4 ton, 46' span. DC Electric crane, complete with runway and motor driven converter.

For Further Information write to

KLATZKY BROTHERS
Box 295, Newberry, Michigan

DIESEL UNITS
625 H.P. Cooper Bessemer 240 V.—D.C.
300 KVA Fairbanks Morse 2400 V.
2—100 KW Chicago Pneu. 250 V. D.C.
300 KW Busch Sulzer 240 V.
250 H.P. Busch Sulzer 257 rpm. Engine.
225 H.P. Buckeye 460 rpm. Engine.
192 KW McIntosh Seymour 2300 V.
100 KW Busch Sulzer 2300 V.
2—11,500 & 20,000 Gal. Steel Tanks.
R. C. STANHOPE, Inc., 60 E. 42nd St., N.Y. 17, N.Y.

FOR SALE

STOKER

1—New Detroit Roto Stoker, three 27" rotors, 13x9' stationary grates, complete. Purchasing power, reason for selling.

GOODMAN LUMBER COMPANY
Goodman, Wisconsin

200, 140, 125, 100 KW AC UNIFLOW SETS
200, 50 KW DC UNIFLOW SETS
Turbo, Water Wheel gen. sets, boilers
150 ton Ice Machine, Uniflow drive
1500 HP Cochrane Lea V open heater
80, 60, 25, 15 HP DC 115V. motors
60 HP Ideal 3/60-440 V. 720 RPM SC.
M.G. Sets, Transformers, pumps etc.

JAS. K. HOOPER
50 CHURCH ST., New York City 7

NEW G-M POWER UNITS

120 HP, Model 6-71, 1200 RPM, radiator cooled, clutch, extended shaft, outboard bearing. Prompt delivery.

I. J. CROWLEY
282 Fisher Ave. White Plains, N. Y.

FOR SALE

2—25 KW TURBO-Generators

Westinghouse Type K 125 Volts DC

Brand New Crated for Export complete with 2-sets spare parts. Bronze Lube oil coolers, switches, starters, and enough spare parts to build another unit. W.S.P. 200# Generator 200 RPM Turbine 3700 RPM.

Also

10—80 GPM Marley all California Redwood Atmospheric Cooling Towers New Crated for Export.

Also

2.5 KVA 230 Volts DC to 115—1—60 AC Rotary Converter by Continental Electric complete with controls. New.

Highest Cash Offer will take this material.
Need Spare.

GEORGE W. STETSON, JR.
141 Milk St. Boston, Mass.

1—75 KW General Electric Generator
1—Skinner Uniflow Engine and all lubrications used in connection therewith
1—Fairbanks Morse Altmeter
1—Panel Board plus all electric equipment
1—Volt Regulator
1—Bolted Excitor

THE SOUTH SIDE LAUNDRY, INC.
Foxhurst Road Baldwin, L. I.

1—Fitchburg Steam Engine, 125 H.P. at 110 lb. Steam Pressure, Excellent Condition.
1—G. E. A.C. Generator, 100 K.W. Speed 900 & Exciter.
1—Worthington Boiler Feed Pump. Size 5¼x3½x5.
1—National Feed Water Heater #20.
1—Garden City Fan (Cycloidal) 42"x18", 17"x19" outlet.

GRANITE LEATHER CO.
Greenville, New Hampshire

FOR SALE

ENGINE & GEN.

One 14 x 17" Chuse NRC Engine connected to 120 KVA-3-60-240 G.E. Generator in excellent condition, can be run as is.

Address
P. O. Box 244, Memphis, Tenn.

RIDGEWAY

SYNCHRONOUS GENERATOR SET

Generator 250 KW 125 volt direct current compound interpole
Motor 4100 volt 3 phase 60 cycle 1200 RPM complete with all controls

MID-WEST MACHINERY MART
2122 E. Washington St. Indianapolis, Ind.
Phone Franklin 2944

POWER PLANT EQUIPMENT

1—43" x 14"—3 cyl. Vert. West. Gas Engine #264

1—100 K.W. West. Gen. 550 rpm, 250 V., 440 A-D.C. Belt Drive—with 14" x 50'—Endless leather belt

1—18"-29" x 27"-16½" x 24" Worthington Air Compressor 2 stage Air, Compound Steam, with intercooler, L26711 Laidlaw

1—15" x 22"—210 HP 3 cyl. Vert. West. Gas Engine #414 Direct Connecting to 225 rpm

1—100 K.W. Crocker-Wheeler Generator 250 rpm, 250 V. D.C.

1—18" x 22"—285 HP, 3 cyl. Vert. West. Gas Engine

1—200 K.W., G.E. Generator Belted, 450 rpm, 220 V. D.C. Belt Drive, with 31" x 45'—Endless Leather Belt

1—25" x 25" Fleming Piston Valve Steam Engine Generator Set, 150 rpm with base

1—275 K.W. G.E. Generator, outboard Ped. Bearing Type MP, Class 8, Form RB, 240 V., 150 rpm, 1100 A

BENKART STEEL & SUPPLY CO.
2017 Preble Ave., Pittsburgh 12, Pa.

POWER EQUIPMENT

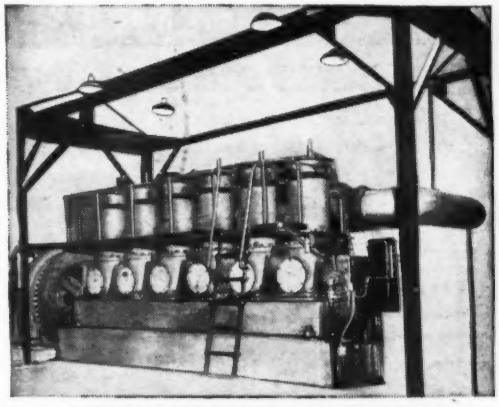
Horizontal Corliss Engines—500 HP
Kewanee Boiler—200 HP
800 GPM Marley Forced Draft Cooling Tower
New Worthington 200 GPM Feed Water Pump with Moore Turbine
All used equipment in good operating condition
Will sell basis FOB cars Leavenworth
Immediate delivery

THE J. C. LYSLE MILLING COMPANY
Leavenworth, Kansas

300 KW ELECTRIC POWER PLANT

Complete . . . Immediate Delivery

FAIRBANKS-MORSE Diesel Electric GENERATING PLANT



Latest Model Never Operated

Engine Model 32 D 14 Generator Type TGZO

- 6 CYLINDERS • 3 PHASE • 60 CYCLES
- 2400/4160 VOLTS • 300 R.P.M. • PANEL BOARD
- ALL UNITS NECESSARY FOR OPERATION.

Send for detailed specifications

WIRE • WRITE OR PHONE MAin 4-5181

Benjamin's for Motors 130 CLINTON STREET BROOKLYN 2, NEW YORK

COMPLETE 2000 KW CONDENSING PLANT

Curtis G.E. 4-stage 3600 RPM Turbo-Generator Complete with Spiroflo Surface Condenser and all accessories including 4000 gal. circulating pump. Produces at 600V., 3 ph., 60 cy., A.C. Foster Wheeler Cooling Tower installed new in 1941. Two Exciters.

MAVERICK MILLS
East Boston, Mass.

FOR SALE

1—750 hp Hamilton Corliss high speed cross compound rolling mill type engine complete with rope drive, tension carriage tracks, pumps gauge board with instruments.

1—330 hp Heinie water tube boiler, 188 tubes complete with regular fittings, fixtures and stack. Also steel H supports front and rear cross beams and U bolts for boiler suspension.

Can be seen in operation in North Texas. Available approximately May 1, 1947.

P. O. Box 6331 Dallas 2, Texas

- G.E. 400-KW vert. 3 ph-60 cy.-600 V 180-RPM, gen. with 36", 18'-23' head Leffel waterwheel, Woodward electric drive gov, motor-generator exciter, complete switchboard and auxiliaries.
- G.E. 400-KW vert. 3 ph.-60 cy.-2300-V 225-RPM with 30", 24' to 30' head Leffel waterwheel Woodward gov.
- G.E. 400-KW horiz. 3 ph.-60 cy.-2300-V-180 RPM 2-bearing alternators.
- Westinghouse 200 KW 3 ph-60 cy.-2300 V 200 RPM alternators.
- Two G.E. 50-and 60-KW 3 ph.-60 cy-2300 V alternators complete with 12' to 30' head waterwheel
- Two Leffel scroll 50' to 200' head waterwheels with outside gate connections. Woodward gov.
- G.E. 100-KVA Horiz. 3 ph.-60 cy.-2300 V 900 RPM.

All above subject to prior sale.

WE BUY AND SELL.

W. C. MOULTON
MONSON, MASS.
Tel. 129-2

BOILERS

2—400 H.P. Erie City, type E stokers, OHIO, PENNSYLVANIA & ASME stamping.
2—400 H.P. Springfield sectional header, oil burners, N. J. & ASME stamping.
2—25,000# B & W Stirling's, unit pulverizers, National Board Stamping.

H. P. BREARLEY
3423-91st Street, Jackson Heights, N. Y.

500 Volt 600 K.W. DIESEL GENERATOR SET

General Motors Model 12-567, 12 Cyl., 2 Cycle, 720 RPM. Like new in stock, ready to ship.

ALJON DIESEL CO., INC.
904-10 Pacific St. Brooklyn 16, N. Y.
Sterling 3-6515

FOR SALE

60, 100, 125, 150, 200 HP Slip Rg. Motors
60, 100, 150, 250, 300 HP Sq. Cage Motors
175 HP (2) 260# P. Marine Boilers
950 HP, 250 V. DC Motor Vari. Speed
750 KW, 250 V. DC Turbo Gen. Set
32" Dredge Pump—motor driven
1" to 6" 250# Pipe with valves, etc.

H. & P. MACHINERY CO.
6719 Etzel Ave. St. Louis 14, Mo.

AIR COMPRESSORS

2—3874 FT. CAP. Chicago Pneumatic 700 H.P. 3 PH. 60 CY. 2300 V. Class OCE, Latest Type Practically New Air Compressors, with Receivers and Aftercoolers.

Immediate Delivery

R. C. STANHOPE, INC.
60 East 42nd St. New York 17, N. Y.

FOR SALE

COMPRESSOR

300 H.P. Clark RA3 Gas Engine Driven Compressor with or without compressor cylinders. Brand new.

R. H. ARMSTRONG
Box 1191, Texas City

WANTED

(Additional Wanted Ads on page 296)

-TRANSFORMERS-

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes

ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"

MARIEMONT Since 1912 CINCINNATI 27, OHIO

Cash Ready

FOR YOUR

ELECTRICAL EQUIPMENT

Electric motors, AC and DC
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment

Send us list with full details

WIRE OR PHONE

P. O. Box 534

POWER EQUIPMENT CO.

373 SO. GOODMAN ST., ROCHESTER 7, N. Y.

Phone Hillside 2041

WANTED

2—300 H.P. Boilers with stokers in exchange for

2—600 H.P. Springfield Crossdrum Boilers complete with Harrington stokers, including steel structure, soot blowers, superheaters, forced draft fan and vertical reciprocating steam engine 8x8. Approved for 200# working pressure. Completely dismantled ready for immediate shipment.

MIDWEST MFG. COMPANY

Galesburg, Illinois

Air Compressors Wanted

Horizontal Water Cooled—Any size also 2 Stage portable units

L. W. BAUER

North Bergen, N. J.

WANTED

MOTORS

1 or 2, 175 HP Type DMC, Class 209 (6—175 HP 500) form L, 500 RPM, 230 volt—Reply

W-223, Power
330 West 42nd St., New York 18, N. Y.

---

3 A.S.M.E.
WATER TUBE BOILERS

400 horsepower each, designed pressure 200 psi, maximum age 10 years.

W-255, Power
330 West 42nd St., New York 18, N. Y.

WANTED *New or Used*

ELECTRIC MOTORS, GENERATORS, TRANSFORMERS, AIR COMPRESSORS

FOR QUICK RESULTS

WRITE — WIRE — PHONE

Our Representative with Authority to Purchase Will Call Immediately

AMERICAN ELECTRICAL EQUIPMENT CORP.

59 EDISON PLACE, NEWARK 2, N. J.

WANTED

DIESEL ENGINES

1000, 1200 KW, 3 phase, 60 cycle, 2300 volts. 1, 2 or 3 units.

W-245, Power
330 West 42nd St., New York 18, N. Y.

WANTED

1500 KVA TRANSFORMER

Oil immersed, 3 phase, 60 cycle, 4160 volts delta primary, 480 volts, delta secondary, or 3-500 KVA transformers, 2400 volts primary.

Advise with Offers and Full Particulars

JOHNS-MANVILLE CORPORATION
Manville, New Jersey
H. PONISI, *Purchasing Agent*

WANTED

Two D.C. MOTORS

TYPE MPC, CLASS 6—150 H.P. 500. Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

W-973, Power
330 West 42nd St., New York 18, N. Y.

WANTED

MOTOR

One Used 50 HP, 115 Volt D.C. Motor, compound wound, 1200 R.P.M. G.E., Westinghouse or Allis Chalmers preferred. Reply

W-243, Power
330 West 42nd St., New York 18, N. Y.

WANTED

1—350 H.P., 1800 R.P.M., Slip Ring Motor with control for 20% speed reduction.
1—350 H.P., 1800 R.P.M. Input, 3900 R.P.M. Output, Step-up Gear.

JOHNSON & JOHNSON

New Brunswick, N. J.

DIESEL GENERATORS WANTED

ALTERNATING CURRENT

Slow speed, 60 cycle, 3 phase, any voltage.

300 KW, 300, 327, 360 RPM
300 KW, 400, 450, 514 RPM
500 KW, 300, 327 RPM
600 KW, 720, 900 RPM
1000 KW, 720, 900 RPM
1500 KW, 257, 300 RPM

DIRECT CURRENT

1000 KW, 230 volts, 720 RPM

We are prepared to place immediate orders for suitable equipment.

W-244, Power
330 West 42nd St., New York 18, N. Y.

WANTED

Two Stage steam jet ejector with or without precooler and intercondenser, rated 40 lbs per hour air-water vapour mixture. Inlet steam pressure 140 psi.

CIA. HULERA DE PARRAS, S. A.
Apartado Postal 16
Parras, Coah, Mexico

WANTED

15 TON DIESEL LOCOMOTIVE

standard guage
M.C.B. Fitted

ANDREW S. FORMAN CO.,
1425 Dorcester St. W. Montreal, Que.

NEW IN NAME—OLD IN EXPERIENCE

TRUMBULL INDUSTRIAL SERVICE OFFERS FOR SALE

POWER PLANT EQUIPMENT, BUILDINGS, CRANES, COMPRESSORS, BOILERS

STEEL BUILDINGS

1 Steel Building 60' x 300' with runways
1 Steel Building 100' x 400' " "
2 Steel Buildings 60' x 75' " "

BOILERS

3 500 H.P. Connally Sterling Boilers built for 250# all appurtenance and building including stokers, ash handling equipment and pumps. Built and installed 1930.

TURBINE GENERATORS

1 1000 K.W. G.E. 230 V. D.C. Turbine Generator, Worthington condenser, Curtis steam turbine, Worthington condenser pump, Worthington dry air or vacuum pump and De Laval Turbine oil separator.

1 500 K.W. G.E. 230 V. D.C. Turbine Generator, Worthington condenser, Curtis steam turbine, Worthington condenser pump and dry air or vacuum pump.

1 250 K.W. Buckeye Turbine & G.E. Continuous Current Generator 230 V. D.C. Ser. #44868 Type M.P.

COMPRESSORS

1 Ingersoll-Rand installed 1927 Serial #42497-8-PP, 2 Stage Compound. Imperial Type 10 PW, 1980 CFM at 160 RPM, 2100 CFM at 170 RPM.

1 Compressor — Chicago Ser. #5132 Class G, 2 Stage Compound. 394 H.P. Max RPM 120, 2035 CFM.

1 Compressor—Bury Ser. #3963 Class VCCE Size 16" x 16" x 14" x 16", 100# press. at pump. 257 RPM, 1600 CFM with Syn. Motor Ser. #308813 & G.E. Exciter Motor with Panel.

CRANES

(Morgan Engineering Co., all with crane runways).

3 10-ton O.E.T. Cranes D.C. 58' Span
1 10-ton
1 50-ton 5-ton Aux.
1 10-ton Horizontal Charging Crane 75 ft. span, D.C.

LADLES

7 30-ton Openhearth Ladles

LEVELER

1 Leveler—Plate 9 Roll Hy Type

FANS

2 Fans—Clarage Floor Force Draft. Complete

HAMMERS

1 Hammer—Steam Double Frame 2000# Serial #1931
1 Hammer Steam Single Frame 1100# Serial #1801

Misc. Pumps, Steam Engines, Wiring and many other items too numerous to mention

Complete Details on Any of the Items Upon Request.
Write, Wire or Phone, or May Be Inspected At
Jones & Laughlin Otis Plate Mill

TRUMBULL IND. SERVICE, INC.

3201 LAKESIDE AVENUE PHONE MAIN 5297 **CLEVELAND 14, OHIO**

Main Office, P. O. Box 67, Niles, Ohio

Operated by M. J. McHenry, Pres., E. L. Krause, Vice Pres., S. V. Wilder, Legal Adv., F. Connell, Sec. & Treas., Benjamin Charles, Gen. Supt., and Richard Shadle, Supt. (All formerly associated with Hetz Const. Co.)

FOR SALE

PRESSURE EQUIPMENT

OIL ACCUMULATORS — 5500# per sq. in. test pressure, 10' x 60" dia.

AIR FLASKS—5500# per sq. in. test pressure, 35' x 19" dia.

TENSIONER RESERVOIRS — 2000# per sq. in. test pressure, 30" x 13" dia.

AIR & LIQUID ACCUMULATORS —12,000 cu. in. minimum capacity. 1500# per sq. in. test pressure, 45" x 25" dia.

BARRIER CYLINDER—3' x 6" dia.

Above material from naval catapults and arresting gear.

Contact

NATIONAL BULK CARRIERS
INCORPORATED
630 Fifth Ave., New York 20, N. Y.

FYR-FEEDER

MULTIPLE SPREADER **STOKER**

SAVES COAL, SAVES LABOR
IT'S AUTOMATIC, EFFICIENT!

PAYS FOR ITSELF
OVER AND OVER AGAIN

WRITE OR WIRE FOR INFORMATION

AMERICAN COAL BURNER CO.
Chicago R-11, Ill.

Since 1899—Engineers, Originators and Builders of Thousands of Industrial Grates and Stokers

---

D. C. Steam Engine GENERATOR SETS

General Electric, 300 K.W. 175 R.P.M., 125 volt, driven by Chuse cross compound 17" x 28" H.P. 28" x 28" L.P.
Sprague, 250 K.W. 180 R.P.M., 125 volt, driven by Chuse 4 valve 20" x 24"
Western Electric, 175 K.W. 180 R.P.M. 120 volt driven by Ball—4 valve 18" x 24"
Westinghouse, 125 K.W. 180 R.P.M. 120 volt, driven by Chuse—4 valve 14" x 21"

Contact: Julius Boehmer, Jr.

RICE-STIX DRY GOODS CO.
1000 Washington Ave., St. Louis 1, Mo.

FOR SALE

GENERATOR

1,000 k.w. Terry extraction turbine driven Allis-Chalmers generator, 250 p.s.i. inlet steam, 30 pound exhaust pressure. 440 volts, 3 phase, 60 cycle, complete with Westinghouse condenser, condensate pump, etc.

This machine is available for very early shipment and is in excellent operating condition.

For complete details contact,

Mr. R. F. Toma, *Purchasing Agent*
NATIONAL LEAD COMPANY
Titanium Division
St. Louis 11, Mo.
Lo 3980

FOR SALE COMPLETE STEAM-ELECTRIC GENERATING PLANT

Now in Operation at Toledo, Ohio

3—AMES UNIFLOW VERTICAL ENGINES with direct connected Crocker-Wheeler D.C. Generators 400-500 & 600 K.W. 2 Wire, 250 Volts

ERIE CITY CROSSDRUM W.T. BOILER 514 H.P. with Detroit Multiple Retort Stoker

3—SPRINGFIELD WATER TUBE BOILERS EA. 408 H.P. with Taylor underfeed Stokers

ELLIOT DEAERATING FEEDWATER HEATER, 75,000 lbs. per hour

3—CENTRIFUGAL BOILER FEED PUMPS 190 G.P.M. 1—Motor Drive—2—Turbine Drive

NASH—L-3 VACUUM PUMP, Turbine Drive, 200,000 Sq. Ft. E.D.R.

FORCED AND INDUCED DRAFT FANS, BAILEY-REPUBLIC METERS and other Boiler-Engine Room Auxiliaries

For Further Particulars Address
FS-257, Power
330 West 42nd St., New York, 18, N. Y.

FOR SALE

BOILERS & ENGINES

2—150 HP Bros Horizontal Tubular Boilers 125 pounds Working Pressure Complete with Stokers, valves and fittings.
300 HP Allis Corliss Engine.
150 HP A. C. E. For details—Inquire or write

SCHUCHARD BROS.
1901 2nd St. N. *Minneapolis, Minn.*

FOR SALE
2—Boilers Vertical Type
1—35 H.P.
1—40 H.P.
with Stokers

Can be inspected at York, Pa. Subject to Prior sale.

The Seneca Wire & Mfg. Company
Fostoria, Ohio

FOR SALE

General Electric Co., (Schenectady, N. Y.) 90 k.w. A/C GENERATOR—Ser. #5214042—type ATB—form BL—3 phase 60 cycle 480 volt 1200 R/P/M—80% P.F.—40 degree rise—125 excitation volts—with 4 k.w. D/C generator exciter—Ser. #1608499—type EF—Form EB—32 amps. 125 volts—mounted on generator shaft—coupled to turbine through 1 General Electric Co. type S-79 form F 90 k.w. reduction gear—5214/1200 R/P/M. 1 General Elec. Co. 90 k.w. type D-53 single stage steam turbine Ser. #38806—non-condensing—125# working steam pressure 5214 R/P/M with 1 Andale Engineering Co. #100-A-34 type 201S oil cooler. 1 fabricated steel sub-base for generator—reduction gear and turbine.

HOLLAND FURNITURE CO.
146 River Ave. Holland, Michigan

ADVERTISERS' INDEX

Where an • appears after a name the advertisement does not appear in this issue, but appeared in preceding issues

Adams Co., R. P. ..... •
Air Preheater Corp. 235
Air Transport Ass'n of America for Railway Express Agency 152
Ajax Flexible Coupling Co ..... •
Alco Products Div. 266–267
Aldrich Pump Co. 273
Allen-Sherman-Hoff Co. ..... •
Allis-Chalmers Mfg. Co. 43
Alloy Steel Products Co. ..... •
Allpax Co. 198
American Brass Co. 129
American Chain & Cable Co. 199, 212
American Chimney Corp. ..... •
American Coal Burner Co. ..... •
American District Steam Co. ..... •
American Engineering Co. 34, 41
American Locomotive Co. 266–267
American Manganese Steel Div. 227
American Metal Hose Branch ..... •
American Pulverizer Co. 205
American Sand-Banum Co. ..... •
Ames Iron Works 191
Anchor Packing Co. 189
Anderson Co., V. D. 149
Arkansas Fuel Oil Co. ..... •
Armstrong Cork Co. 243
Armstrong Machine Works 100–101
Asbestos Textile & Packing Div. Raybestos Manhattan, Inc. 277
Atlas Valve Co. ..... •
Automatic Control Co. ..... •

Babbitt Steam Specialty Co. 214
Babcock & Wilcox Co. 4–5
Babcock & Wilcox Tube Co. ..... •
Badger & Sons Co., E. B. 195
Bailey Meter Co. 10–11
Baldwin-Hill Co. 158
Bartlett Hayward Div. (Koppers Co.) 256
Bartlett & Snow Co., C. O. 265
Beaumont-Birch Co. 198
Belco Ind. Equipment Div. ..... •
Belmont Packing Co. 210
Betz & Co., W. H. & L. D. 223
Biddle Co., James G. 200
Bird-Archer Co. ..... •
Black, Sivalls & Bryson, Inc. ..... •
Blaw-Knox Co. 57
Boiler Tube Co. of America 278
Brickseal Refractory Co. 208
Bridgeport Brass Co. 293
British Industries Fair 224
Brooke Engrg Co. ..... •
Brown Boveri Corp. 16–17
Brown Instrument Co. ..... •
Brownell Co. ..... •
Brunt Equipment Co. ..... •
Buell Engrg Co. 166
Buffalo Forge Co. 249
Buffalo Pumps, Inc. ..... •
Burke Electric Co. 254
Bussmann Mfg. Co. 22–23
Byers Co., A. M. 62
Byron Jackson Co. 215

Cabot, Inc., Samuel ..... •
Canton Stoker Co. ..... •
Carbide & Carbon Chemicals Corp. 292
Carborundum Co. ..... •
Cardox Corp. 272
Cash Co., A. W. 167
Cash Valve Mfg. Corp., A. W. 272
Chapman Valve Mfg. Co. 147
Chase Brass & Copper Co. ..... •
Chicago Metal Hose Corp. ..... •
Chicago Pneumatic Tool Co. ..... •
Cities Service Oil Co. ..... •
Clarage Fan Co. 268
Clark Mfg. Co. 228
Cleaver-Brooks Co. ..... •
Coats Machine Tool Co. 292
Cochrane Corp. 281
Coffin, Jr. Co., J. S. 211
Combustion Engrg Co. 30–31
Condenser Service & Engrg Co. ..... •
Coppus Engrg Corp. 217
Corning Glass Works ..... •
Crane Co. 131
Cryer Trap & Valve Co. ..... •
Cutler-Hammer, Inc. 119
Cyclotherm Corp. 250

Dampney Co. of America 239
Dart Mfg. Co., E. M. 206
Davis Regulator Co. 182
Dayton Rubber & Mfg. Co. ..... •
Dearborn Chemical Co. ..... •
De Laval Separator Co. 42
De Laval Steam Turbine Co. 58, 208
Deming Co. 150
Detroit Stoker Co. 36–37
Diamond Power Specialty Corp. 8–9
Dings Magnetic Separator Co. 172
Dodge Mfg. Corp. 173
Dominion Chemical Co. ..... •
Dowell Inc. 261
Dravo Corp. 177
Dudgeon, Richard ..... •
Dunham Co., C. A. 180

Eagle Picher Sales Co. 258
Edge Moor Iron Works, Inc. 151
Edward Valves, Inc. 125
Electric Fish Screen Co. 218
Electric Machinery Mfg. Co. 247
Electric Storage Battery Co. ..... •
Electro Metallurgical Co. ..... •
Elgin Softener Corp. ..... •
Elliott Co. 6–7, 283
Engineer Co. 153

Fairfield Engrg Co. 332
Fairmont Coal Bureau 185
Flexitallic Gasket Co. ..... •
Flexo Supply Co. 190
Flexrock Co. 284
Flynn & Emrich Co. ..... •
Foster Engrg Co. 236
Foster Wheeler Corp. 14–15
Foxboro Co. 226
Frick Co. ..... •
Fuller Co. 170
Fyr-Feeder Spreader Stoker Co. ..... •

Gardner-Denver Co. 159
Garlock Packing Co. 161
General Coal Co. ..... •
General Controls Co. 280
General Electric Co. (Apparatus Dept.) 35
General Electric Co. (Appliance & Merch. Dept.) 27
Gifford-Wood Co. 213
Gilmer Div., L. H., of U. S. Rubber Co. •
Globe Steel Tubes Co. ..... •
Goetze Gasket & Packing Co. ..... •
Golden-Anderson Valve Specialty Co. 40
Goodyear Tire & Rubber Co. ..... •
Goulds Pumps, Inc. ..... •
Greene, Tweed & Co. 221
Grinnell Co. ..... 3rd Cover
Griscom-Russell Co. 285
Gulf Oil Corp. 231
Gulf Refining Co. 231

Haering & Co., D. W. ..... •
Hagan Corp. 28–29
Hahn Equipment Corp. 284
Hall Laboratories 50–51
Haynes Stellite Co. 26
Hays Corp. 275
Hays Institute of Combustion 194
Heacon, Inc. ..... •
Helicoid Gage Div. (Am. Chain & Cable Co.) 212
Hendrick Mfg. Co. 288
Henszey Co. 202
Hercules Float Works 208
Hewitt Rubber of Buffalo, Div. of Hewitt-Robins, Inc. 201
Hill Pump Valve Co. 292
Hoffman Specialty Co. ..... •
Homestead Valve Mfg. Co. 291
Honan-Crane Corp. ..... •
Hoppes Mfg. Co. 276

Illinois Water Treatment Co. 168
Infilco, Inc. 176
Ingersoll-Rand Co. 169
Inland Steel Co. 160
International Cementers, Inc. 246
International Nickel Co. 38
Iron Fireman Mfg. Co. 20–21

Jefferson Union Co. 178
Jeffrey Mfg. Co. 259
Jenkins Bros. 136–137
Johns-Manville, Inc. 141
Johnson Service Co. ..... •
Joy Mfg. Co. (La-Del Div.) ..... •
Joy Mfg. Co. (Sullivan Div.) 179

Keasbey & Mattison Co. 197
Kellogg Co., M. W. 271
Kennedy Valve Mfg. Co. 270
Kennedy Van-Saun Mfg. & Engrg Corp. 18–19
Kewanee Boiler Corp. 198
Kieley & Mueller, Inc. 276
Koppers Co. 256
Kuljian Corp. 164

Ladish Co. 174–175
Laminated Shim Co. ..... •
Leeds & Northrup Co. ..... 2nd Cover
Leslie Co. ..... •
Lincoln Electric Co. ..... •
Linde Air Products Co. ..... •
Link-Belt Co. 3
Liquid Conditioning Corp. ..... •
Liquidometer Corp. 280
Lovejoy Flexible Coupling Co. ..... •
Lubriplate Div., Fiske Bros Refining Co. •
Lummus Co. 230
Lumnite Div., Univ. Atlas Cement Co. ..... •
Lunkenheimer Co. 46–47

Madden Co., P. E. 218
Manhattan Rubber Div., Raybestos Manhattan, Inc. ..... •
Manheim Mfg. & Belting Co. ..... •
Manzel Brothers Co. ..... •
Marion Machine, Foundry & Supply Co. •
Marley Co. 52
Marlow Pumps, Inc. 276
Marsh Corp., James P. 294
Mason-Neilan Regulator Co. 157
McAlear Mfg. Co. 245

McGraw-Hill Book Co. 278
Mercoid Corp. 186
Midwest Piping & Supply Co. 253
Minneapolis-Honeywell Regulator Co. 264
Modine Mfg. Co. 262
Mortell Co., J. W. 204
Murray Iron Works Co. 216

National Airoil Burner Co. 282
National Aluminate Corp. 135
National Supply Co. 252
National Tube Co. *
National Valve & Mfg. Co. 53
Niagara Blower Co. 192
Nicholson Co., W. H. 204, 280
Nordberg Mfg. Co. 279
Northern Equipment Co. 139
Norton Co. *
Nutmeg Chemical Co. 178

Oakite Products Co. 186
Ohio Injector Co. 232
Orr & Sembower, Inc. *
Otis Elevator Co. 238

Pacific Pumps, Inc. 241
Peabody Engrg Corp. *
Peerless Pump Div. 194
Pennsylvania Salt Mfg. Co. 257
Permutit Co. Back Cover
Philadelphia Gear Works 260
Pipe Fabrication Institute 233
Pittsburgh Piping & Equipment Co. 255
Powell Co., Wm. 54–55
Powers Regulator Co. *
Prat-Daniel Corp. 207
Preferred Utilities Mfg. Corp. 188
Pritchard Co., J. F. *
Proportioneers, Inc. *

Quaker Rubber Corp. *

Raybestos Manhattan, Inc. 277
Reading, Pratt & Cady Div. 199
Reliance Electric & Engrg Co. *
Reliance Gauge Column Co. 44–45
Republic Flow Meters Co. 48–49
Republic Rubber Div. (Lee Tire & Rubber Corp.) 287
Republic Steel Corp. *
Research Corp. *
Revere Copper & Brass, Inc. 133
Ric-Wil Co. 209
Ridge Tool Co. 274, 289
Riley Stoker Corp. 96–97
Robins Conveyors, Inc. Div., Hewitt Robins, Inc. 201
Rockbestos Products Co. 240
Roebling's Sons Co., J. A. *
Roper Corp., Geo. D. 244
Ross Heater & Mfg. Co. *
Roto Div., Elliott Co. *

Sarco Co. 220
Sauerman Bros., Inc. 288
Scherr Co., George 216
Schramm, Inc. 154
Schutte & Koerting Co. *
Scovill Mfg. Co. 32–33
Shaw Co., B. F. 181
Sier-Bath Gear & Pump Co. *
Sinclair Refining Co. 165
Skinner Engine Co. 222
Sloan Valve Co. *
Smith Refractories, Sanford C. *
Smooth-On Mfg. Co. 282
Socony-Vacuum Oil Co., Inc. 145
Springfield Boiler Co. 39
Square D. Co. 219
Squires Co., C. E. 288
Standard Oil Co. of Calif. 187
Standard Oil Co. of Indiana 155–156
Standard Pressed Steel Co. 214
Steel & Tubes Div. *
Sterling Engrg & Mfg. Corp. 216
Stickle Steam Specialties Co. 148
Stock Engrg Co. 196
Stone & Webster Engrg Co. *
Strong, Carlisle & Hammond Co. 248
Struthers Wells Corp. *
Sturtevant Co., B. F. *
Sun Oil Co. 123
Superior Combustion Industries 229
Superior Engine Div. 252
Syntron Co. 272

Taylor & Co., W. A. 214
Taylor Forge & Pipe Works *
Taylor Instrument Co's. *
Templeton Mfg. Co. 216
Terry Steam Turbine Co. 56
Texas Co. 12–13
Thermix Corp. 207
Tidewater Associated Oil Co. 269
Timken Roller Bearing Co. 251
Todd Shipyards Corp. (Combustion Equip. Div.) *
Toledo Pipe Threading Machine Co. 163
Tripp Metallic Packing Co. *
Troy Engine & Machine Co. 162
Tube Turns, Inc. 143

Union Carbide & Carbon Corp. 26
Union Iron Works *
U. S. Gauge Div., American Machine & Metals, Inc. 218
U. S. Steel Corp. *

Viking Pump Co. 190
Vogt Machine Co., Henry 193

Waldron Corp., John *
Wallace & Tiernan Products Inc. 263
Walworth Co. 171
War Assets Administration 286, 290
Warren Steam Pump Co. 284
Watson-Stillman Co. 287
Webster & Co., Warren 127
Western Chemical Co. *
Westinghouse Electric Corp. 60–61
Weston Electrical Instrument Corp. 146
Wheeler Mfg. Co., C. H. 183
Where To Buy 292
Wickes Boiler Co. 225
Wiedeke Co., Gustav *
Wilcolene Mfg. Co. 284
Williams Gauge Co. 184
Wilson, Inc., Thomas C. *
Wing Mfg. Co., L. J. *
Wrigley, Jr. Co., Wm. 274

Xzit Sales Co. *

Yarnall-Waring Co. 24–25, 121
York-Shipley, Inc. 242
Youngstown Sheet & Tube Co. 203

Zallea Bros & Johnson *
Zernickow Co., O. 292

PROFESSIONAL SERVICES 292

SEARCHLIGHT SECTION

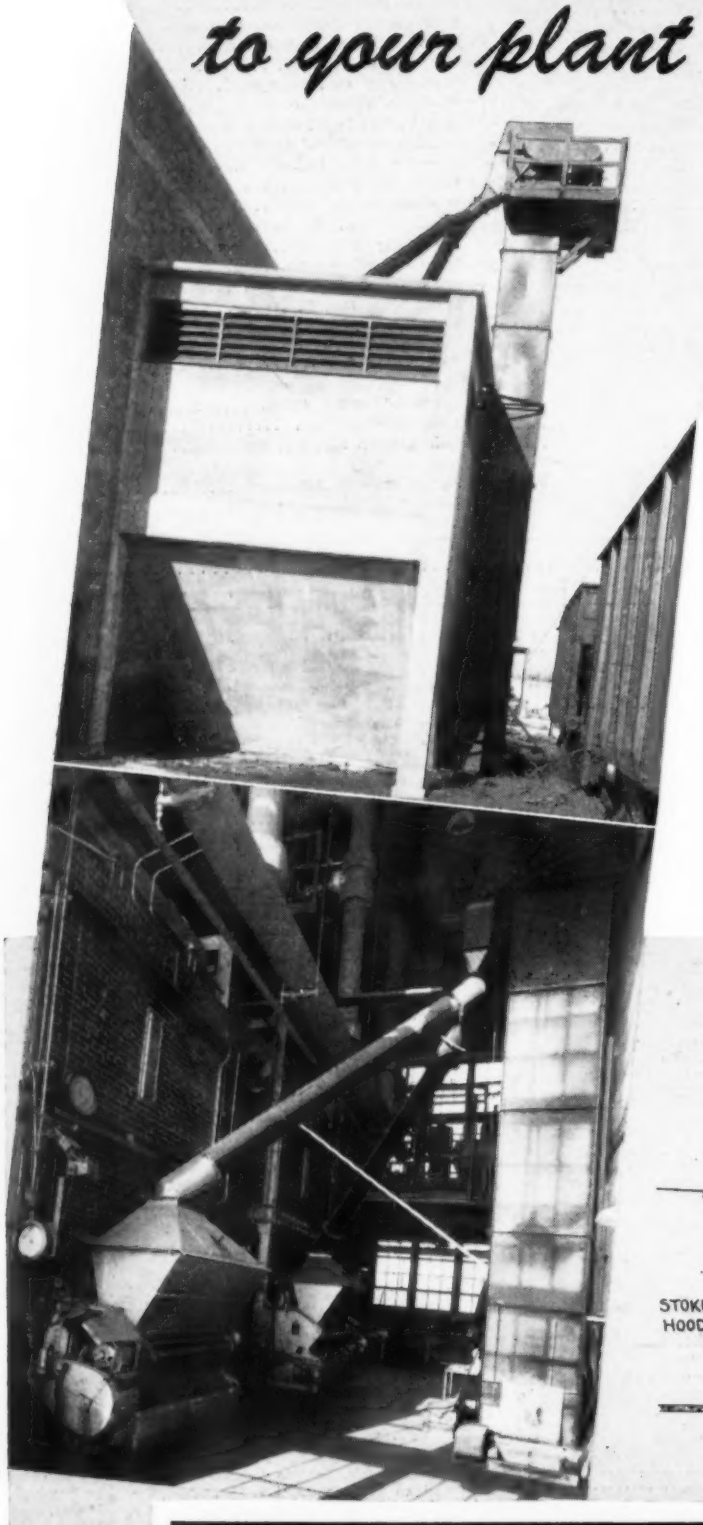
CLASSIFICATION PAGE
EMPLOYMENT 292, 293
POSITIONS VACANT 292, 293
POSITIONS WANTED 292
SELLING OPPORTUNITIES 292
WANTED TO PURCHASE 293, 328
USED EQUIPMENT 296-329

Aljion Elect. Diesel Co. 322, 327
Ace Mchy. & Equip. Co. 324
American Air Compressor Corp. 318
American Electric Equipment Corp. 328
American Coal Burner Co. 329
Armstrong, R. H. 327
Askew, A. C. 325
Atlantic Transformers Co. 321
Bauer, L. W. 328
Belyea Co., Inc. 299
Benjamin's For Motors 322, 327
Benkart Steel & Supply Co. 327
Berger Bros., Elec. Motors Inc. 323
Bickel, Robert B. 325
Birch Manufacturing Co. 325
Brearley, H. P. 327
Brew, Woltman & Co., Inc. 315
Brill Equip. Co. 320
Chicago Electric Co. 317
Cohen Pump & Mchy. Co., Lou. 319, 320
Crowley, I. J. 326
Diesel Motors Corp. 302, 303
Douglas Co., Stephen 318
Duquesne Electric & Mfg. Co. 317
Economy Co., Inc. 327
Electric Apparatus Repair Co. 321
Electric Equipment Co. 325
Electric Generator & Motor Co. 321
Electric Service Co., Inc. 328
Ellis Co., A. Lee 315
Erie Electric Co., Inc. 314
Finn Equip. Co., The 322, 325
First Elec. Motor Mchy. Co., Inc. 313
Fletcher Sales Co. 320
Forman Co., Andrew S. 296, 328
General Machinery Ltd. 314
Glow-Electric Co. 307
Goodman Lumber Co. 326
Granite Leather Co. 326
Guyan Machinery Co. 324
H. & P. Machinery Co. 327
Hall Co., Gordon L. 296
Hall & Co., Stephen 318
Hay & Co., F. W. 326
Heat & Power Co., Inc. 305
Hemphill & Co., Inc., J. L. 297
Holland Furniture Co. 329
Hooper, James K. 296, 326
Howe Brothers 320
Industrial Plants Corp. 324
International Power Machinery Co. 298
Johnson & Assoc., Howard Blaine 320
Johnson & Hoehler Inc. 325
Johnson & Johnson 328
Johns-Manville Corp. 328
Keystone Power Plant Eq. Co. 318
Kiemle Co., Fred W. 321
Kirk Co., Wallace E. 318
Klatzky Bros. 326
Land & Co., L. J. 301
Locke Co., C. B. 319
Lysle Milling Co., J. C. 327
MacCabe Co., T. B. 316
Maverick Mills 327
Metropolitan Plumbing Sup. Co., Inc. 318, 322
Midwest Mfg. Co. 328
Mississippi Valley Equipment Co. 315
Motor Power Co. of N. Y. Inc. 320
Meyer & Sons Co., Wm. W. 296
Mid-West Mchy. Mart 326
Milwaukee Lace Paper Co. 326
Moulton, Wm. C. 327
Municipal Water, Light & Power Plant 324
Nashville, City of 326
National Bulk Carriers Inc. 329
National Lead Co. 329
Neu, Hugo 310
O'Brien Mach. Co., The 325
Old Poindexter Distelley Inc. 296
Penn Machinery Co. 320
Philadelphia Transformer Co. 321
Porter Electric Co., Inc. 324, 325
Power Equipment Co. 328
Power Plant Equip. Co., Inc. 319
Rearick Charles B. 327
Ric-Stix Dry Goods Co. 329
Schoonmaker, A. G. 308, 309, 320
Schuchard Bros. 329
Seneca Wire & Mfg. Co., The 329
Skinner Machinery Co. 323
Smith, A. E. & Lindstrom, L.O.B. 326
South Side Laundry Inc., The 326
Stanhope, Inc., R. C. 326, 327
Stanhope, L. M. 320
Stetson, Geo. W. 326
Stewart & Co. Inc., Paul 311
Sundfelt Equip. Co. 323
Superior Equipment Co. 315, 323
Utilities Electrical Machinery Corp. 304
Thompson Co., Inc., J. Parker 318, 323
Trumbull Ind. Service Inc. 329
Volland Electric Eq. Co. Inc. 316
Wagner & Co., Arthur 319
Weaver & Co., Chas. 306
Wente Electric Co. 300
Wexler Electric Motor Co. 312
Wurth Electric Motor Co. 327
Zenith Transformer Co. 321

FAIRFIELD

FITS YOUR COAL HANDLING SYSTEM

to your plant



• **Here is a typical example of how the Fairfield system of coal handling met this boiler plant's needs.**

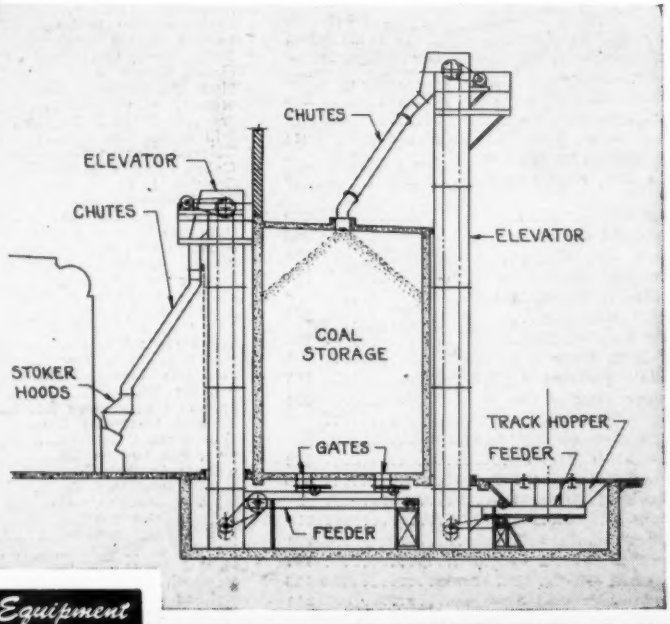
In this instance the coal is transported from the track hopper by a reciprocating feeder to a bucket elevator and through a bifurcated chute to the coal bunker.

A flight feeder under the bunker delivers coal to another elevator inside boiler house. The coal is fed through chutes to the stokers which have large extension hoppers.

This is only one of several Fairfield systems for handling coal automatically from car to storage to stokers or pulverizers.

Your plant conditions—capacity desired—and investment required determine largely the type of equipment our engineers will suggest for your plant.

Why not give us an opportunity to show you how to cut your coal and ash handling costs. Write for complete data.



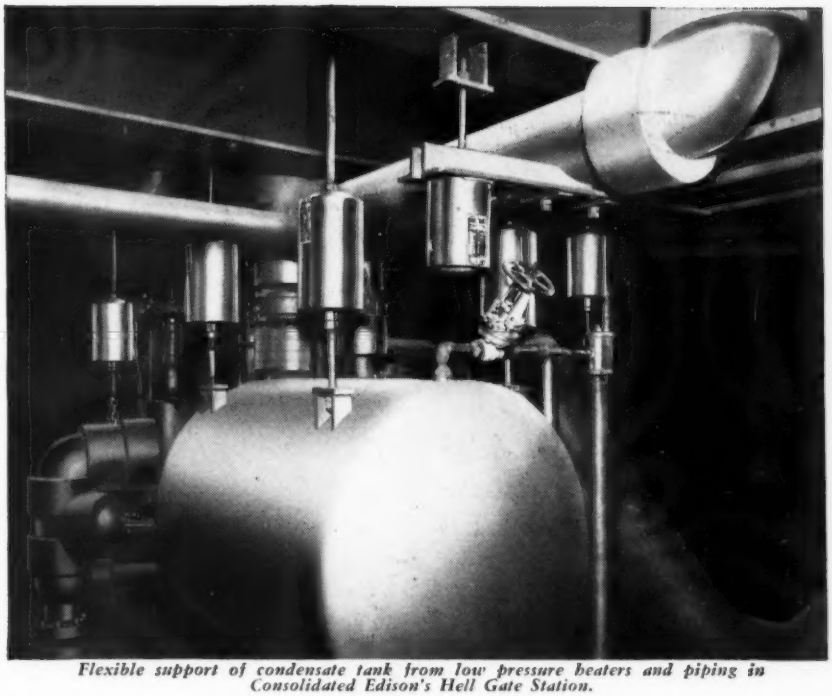
Builders of Coal and Ash Handling Equipment

The FAIRFIELD Engineering Co.

320 CHICAGO AVE. • MARION, OHIO

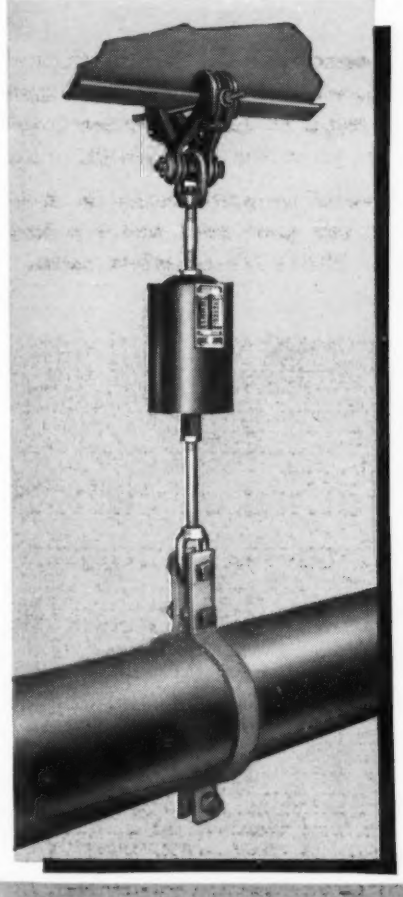
FLEXIBLE SUPPORT OF PIPING

made easy for you



Flexible support of condensate tank from low pressure heaters and piping in Consolidated Edison's Hell Gate Station.

with GRINNELL PRE-ENGINEERED SPRING HANGERS



FLEXIBLE support of piping subject to thermal movement is now a simple matter for you – just select a stock Grinnell Pre-Engineered Spring Hanger that exactly meets the load requirements.

After computing the load it is easy to select the proper size of hanger from a simple capacity table. The 14 sizes include a load range from 84 lbs. to 4700 lbs.

LOOK AT THESE FEATURES . . .

- The maximum variation in supporting force per ½" of deflection is 10½% of rated capacity – in all sizes.
- Guides prevent contact of coils with casing wall or hanger rod and assure continuous alignment and concentric loading of spring.
- Compact – minimum headroom made possible by precompression*
- Precompression* assures operation of spring within its proper working range where variation in supporting force is at a minimum.
- All-steel welded construction meets pressure piping code.
- 14 sizes available from stock – load range from 84 lbs. to 4700 lbs.
- Easy selection of proper sizes from simple capacity table.
- Installation is simplified by integral load scale and travel indicators.
- Unique swivel coupling provides adjustment and eliminates turnbuckle.

**Precompression is a patented feature*

Write for descriptive folder on Pre-Engineered Spring Hangers Fig. 268.

GRINNELL COMPANY, INC.
Executive Offices: Providence 1, R. I.

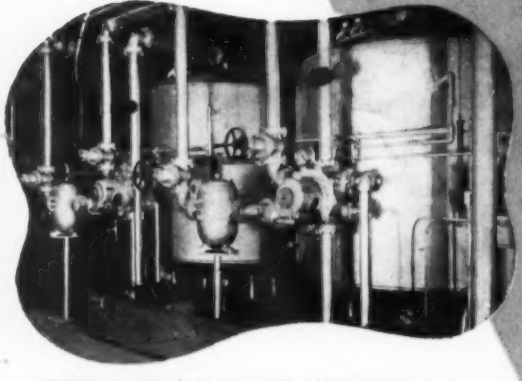
Branch Warehouses

Atlanta 2, Ga.	Los Angeles 13, Cal.	Providence 1, R. I.
Charlotte 1, N. C.	Minneapolis 15, Minn.	St. Louis 10, Mo.
Chicago 1, Ill.	New York 17, N. Y.	St. Paul, Minn.
Cleveland 14, O.	Oakland 7, Cal.	Sacramento 14, Cal.
Houston 1, Tex.	Philadelphia 34, Pa.	San Francisco 7, Cal.
N. Kansas City 16, Mo.		Seattle 1, Wash.

GRINNELL
FOUNDED 1850
WHENEVER PIPING IS INVOLVED

"It's good business to begin with Good Water"

"Sure takes a load off my mind"



PERMUTIT ZEO-KARB* H WATER CONDITIONER removes both hardness and bicarbonates from water. Effluent contains no incrustants, is reduced in total solids and alkalinity. Alkalinity can be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium zeolite unit.

*Trademark Reg. U.S. Pat. Off.

No boiler scaling or corrosion with Permutit-conditioned water

It's a big load off the minds of management, too—once a plant is equipped with Permutit* Water Conditioning. Heavy power loads can seriously damage equipment, and even tie up production. For, as any operating engineer knows, the danger of boiler scale and corrosion of steamlines due to impurities in feedwater *increases* with the load.

Permutit removes this threat to output by removing the impurities in feedwater *before it enters the boilers*. Water conditioning headquarters for the power industry, Permutit provides *every* process for control of water quality.

Don't let untreated water constantly threaten the operating efficiency of your plant. Take a load off your mind . . . bring that water treatment problem to The Permutit Company, Dept. P3, 330 West 42nd Street, New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

PERMUTIT

Manufacturers of ALL types of water treatment equipment

WATER CONDITIONING HEADQUARTERS